TECHNICAL MEMORANDUM NO. 2
SOIL GAS INVESTIGATION
REMEDIAL INVESTIGATION
PHASE I, TASK 1

LENZ OIL SERVICE, INC.
LEMONT, ILLINOIS

REVISION: 1

SUBMITTED BY:

LENZ OIL SETTLING RESPONDENTS

MAY 2, 1991

PREPARED BY:

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PROJECT NO. 0252

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1.0 INTRODUCTION

This Technical Memorandum presents the results of the Soil Gas Investigation conducted as part of the Phase I, Task 1 activities of the Remedial Investigation/Feasibility Study (RI/FS) for the Lenz Oil site. The site is located at the northeast quadrant of the intersection between Route 83 and Jeans Road in Lemont, Illinois. The Soil Gas Investigation was conducted over an area east and southeast of the Lenz Oil site property.

As noted in the Work Plan, the specific objective of the Soil Gas Investigation was to identify a ground water contaminant plume, if any, downgradient of the Lenz Oil site. The results of the Soil Gas Investigation, as well as the results of the fracture analyses presented in Technical Memorandum No. 1, will be used to finalize the placement of downgradient monitoring wells.

Section 3.0 of this memorandum, presents a discussion of the sample analytical results. Modifications to the preliminary locations of monitoring wells are proposed in Section 5.0. All soil gas sampling activities were conducted in accordance with the Lenz Oil Work Plan and the Sampling and Analysis Plan (SAP), unless otherwise indicated.

2.0 SOIL GAS INVESTIGATION METHODOLOGY

The following subsections summarize the methodology employed during the Phase I, Task 1 Soil Gas Investigation at the Lenz Oil site. Reference is made to the Lenz Oil Work Plan and SAP where appropriate.

2.1 Sampling Locations

The Soil Gas Investigation was conducted in the open area east and southeast of the Lenz Oil site as shown in Figure 2-1. Sampling points were located at 50-foot intervals, along the east-west grid lines, which were spaced 100 feet apart, as described in the SAP. This grid system was surveyed and established by licensed surveyors from Patrick Engineering, Inc.

During the early stages of the investigation, bedrock was encountered at depths as shallow as 6 to 8 inches below the ground surface. As a result, it was impossible to drive the sampling probes down to the intended depth of 36 inches at all locations, as indicated in the SAP. Consequently, the probes were driven to the maximum depth possible, which was generally down to the weathered bedrock. Coarse dolomite gravel and cobbles or the actual bedrock itself prevented advancing the soil gas probe beyond this depth. In addition, the sampling locations were slightly modified as a result of the physical inaccessibility to the exact grid intersects because of vegetation interference or rough terrain. These modifications were implemented after approval was secured from the Illinois Environmental Protection Agency (IEPA) representative at the site, who provided project oversight during the field activities. These were the only modifications made to the SAP.

All of the sample locations are listed in Table 2-1 and Figure 2-1. Table 2-1 presents the actual depths to which the probes were driven. A total of 32 investigative soil gas samples were collected from depths ranging from 16 to 36 inches from the ground surface. This number does not include QC samples or blanks.

2.2 Sampling Procedures

Soil gas samples were collected according to the methodology outlined in the SAP. As noted previously, 32 investigative samples were collected. In addition, four field duplicate samples, two MS/MSD sample pairs, five field blanks, and five trip blanks were collected, resulting in a total of 50.

All samples were properly preserved, packaged, and shipped to PACE Laboratories in Minneapolis, Minnesota for analysis according to the protocols described in the SAP. The soil gas samples were analyzed for the contaminants and associated detection limits presented in Table 2-2. These parameters were chosen because of their confirmed presence in the soils and ground water at the site.

The project-required detection limits for soil gas were calculated by modifying those for ground water, using Henry's Law Constant and a conversion factor for expressing concentrations in parts per million by volume (ppmV). The derivation of the detection limits is presented in Appendix A of the Lenz Oil Quality Assurance Project Plan (QAPP). As shown in Table 2-2, the method detection limits achieved by PACE Laboratories are consistently lower than the project-required detection limits.

TABLE 2-1
LENZ OIL

SOIL GAS INVESTIGATION SAMPLING LOCATIONS

SAMPLE I.D.	LOCATION COORDINATES	PROBE DEPTH (inches)
LO-1A1-SG	4+00N, 7+00E	36
LO-1A2-SG	4+00N, 6+50E	18
LO-1A3-SG	4+00N, 6+00E	18
LO-1A4-SG	4+00N, 5+50E	18
LO-1A4-SGFS	4+00N, 5+50E	20
LO-1A5-S5	4+00N, 5+00E	34
LO-1A6-SG	4+00N, 4+50E	18
LO-1A7-SG	4+00N, 4+00E	35
LO-1A8-SG	4+00N, 3+50E	28
LO-1A8-SGMS	4+00N, 3+50E	30
LO-1A8-SGMSD	4+00N, 3+50E	30
LO-1A9-SG	4+00N, 3+00E	36
LO-1B1-SG	3+00N, 7+00E	18
LO-1B2-SG	3+00N, 6+50E	18
LO-1B3-SG	2+90N, 6+00E	16
LO-1B4-SG	3+00N, 5+50E	18
LO-1B5-SG	3+00N, 5+10E	18
LO-1B6-SG	3+15N, 4+55E	18
LO-1B7-SG	3+00N, 4+00E	18
LO-1B8-SG	3+00N, 3+50E	18
LO-1B8-SGMS	3+00N, 3+50E	18

NOTES: Sample locations are relative to the grid system shown in Figure 2-1. QC samples are designated as MS/MSD - matrix spike/matrix spike duplicate; FS and FD are interchangeable suffixes denoting field duplicate samples. Trip and field blanks are not shown.

TABLE 2-1
LENZ OIL

SOIL GAS INVESTIGATION SAMPLING LOCATIONS

SAMPLE I.D.	LOCATION COORDINATES	PROBE DEPTH (inches)
LO-1B8-SGMSD	3+00N, 3+50E	18
LO-1B9-SG	3+00N, 3+00E	19
LO-1C1-SG	2+00N, 6+95E	18
LO-1C2-SG	2+00N, 6+50E	18
LO-1C3-SG	2+00N, 6+00E	18
LO-1C4-SG	2+00N, 5+50E	18
LO-1C4-SGFS	2+00N, 5+50E	18
LO-1C5-SG	2+00N, 5+00E	18
LO-1C6-SG	2+00N, 4+50E	18
LO-1C6-SGFS	2+00N, 4+50E	18
LO-1C7-SG	2+00N, 4+00E	18
LO-1C8-SG	2+00N, 3+50E	18
LO-1C9-SG	2+00N, 3+00E	18
LO-1C10-SG	2+00N, 2+50E	18
LO-1C10-SGFD	2+00N, 2+50E	18
LO-1C11-SG	1+80N, 2+20E	18
LO-1C12-SG	2+00N, 1+50E	18
LO-1C13-SG	2+00N, 1+00E	18
LO-1CD14-S	1+50N, 0+75E	18

NOTES: Sample locations are relative to the grid system shown in Figure 2-1. QC samples are designated as MS/MSD - matrix spike/matrix spike duplicate; FS and FD are interchangeable suffixes denoting field duplicate samples. Trip and field blanks are not shown.

TABLE 2-2

TARGET COMPOUNDS AND ASSOCIATED DETECTION LIMITS

COMPOUND	PRDL (1) (ppmV)	MDL (2) (ppmV)	MDL (3) (ppmV)
1,2-dichloroethane	0.05	0.05	0.04
1,2-dichloroethene (cis)	0.40	0.05	0.04
1,2-dichloroethene (trans)	0.33	0.10	0.08
Trichloroethene	0.34	0.04	0.03
1,1,1-Trichloroethane	0.18	0.04	0.03
Toluene	0.34	0.06	0.05
Xylenes (total)	0.32	0.05	0.04

Notes:

(1) Project-required detection limits for soil gas in ppmV, calculated from the project-required detection limits for ground water (see Appendix A of the QAPP).

(2) Method detection limits (MDL) achieved by laboratory for all samples except LO-1C1-SG. Values are based on a sample volume of 25L.

(3) MDL for sample LO-1C1-SG; these values have been adjusted for a sample volume of 29.4L.

PROJECT#	REPORT#	DRAWN	CHECKED	DATE	APPROVED	CLIENT NAME
0252	TM2	GW		4/29/91		LENZ OIL

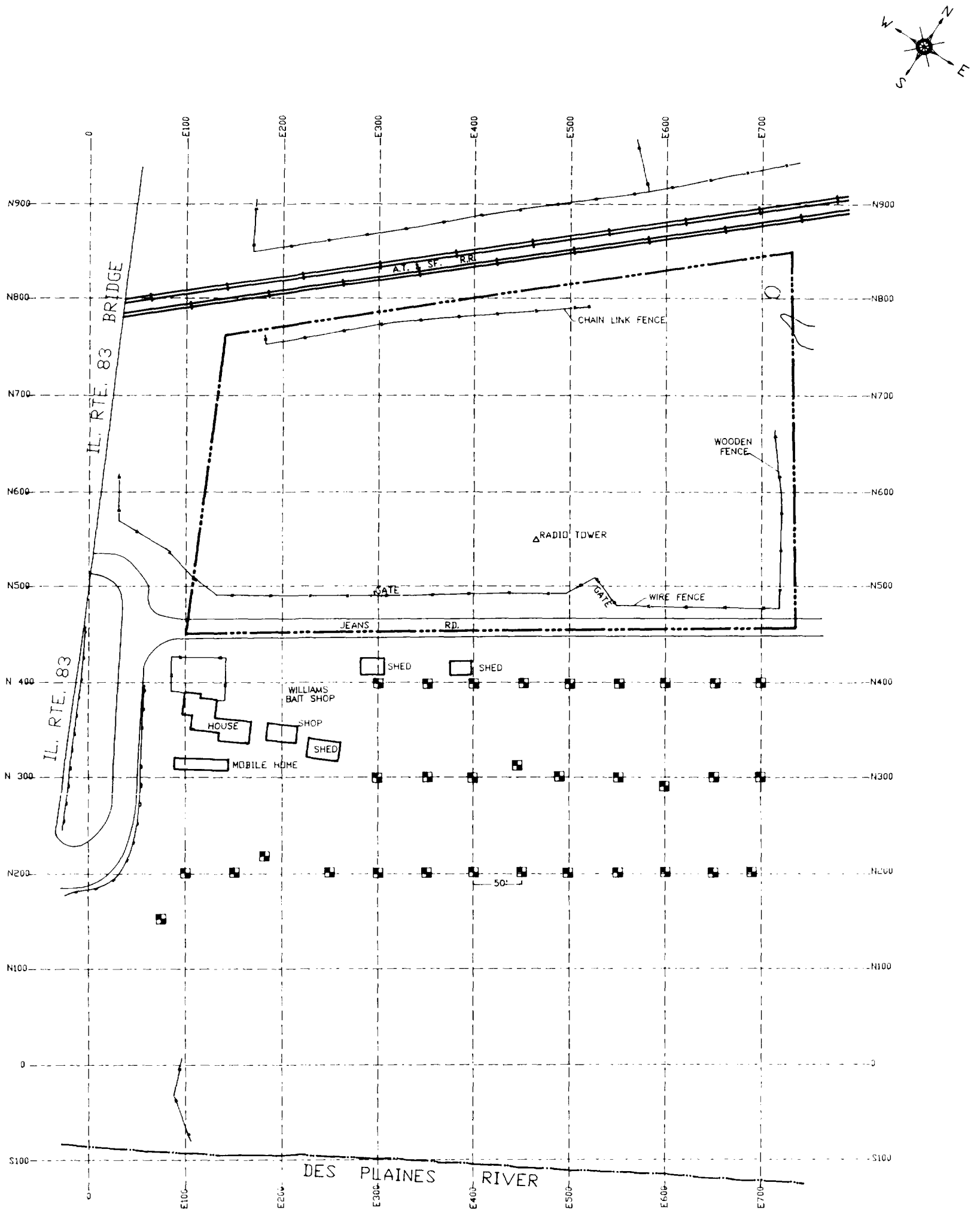


FIGURE 2-1

SOIL GAS SAMPLING LOCATIONS
LENZ OIL SITE

ERM

In addition to the laboratory analyses, field HNu readings of the soil gas were taken at each sampling location through the sample train set ups, as described in the Lenz Oil SAP. All HNu readings were zero.

3.0 ANALYTICAL RESULTS

Table 3-1 presents the laboratory analytical results for the soil gas samples. These data have been validated according to Appendix I of the Lenz Oil QAPP, Standard Operating Procedures for Soil Gas Data Validation. No qualification of the data was necessary. The validation shows that the data are acceptable for the intended uses, except for one field blank analysis (LO-1C1-SGFB) that was qualified as unusable (R). The data validation results are discussed in Appendix A of this Memorandum, and the raw data are presented in Appendix B.

As indicated in Table 3-1, only 2 of the 32 soil gas samples show positive results for any of the target analytical parameters designated for the site. Analytical results for all of the other samples are below the method detection limits. The laboratory result for sample LO-1B9-SG shows concentrations of 0.23 ppmV and 0.10 ppmV for 1,2-dichloroethane and trichloroethene, respectively. A concentration of 0.05 ppmV 1,1,1-trichloroethane was reported for sample LO-1B7-SG. These results are also illustrated on Figure 3-1. The limited number of positive detections does not permit these data to be presented on an isopleth map.

The following technical issues should be considered in reviewing the soil gas analytical data:

1. The shallow nature of the bedrock precluded driving the soil gas probes to the intended depth of 3 feet below ground surface (bgs), and collecting samples closer to the ground water surface. The probability of observing detectable contaminant concentrations at lower depths may have been higher.

TABLE 3-1

LENZ OIL
SOIL GAS INVESTIGATION SAMPLING RESULTS

	SAMPLE I.D.	LO-1A1SG	LO-1A1SGFB	LO-1A2SG	LO-1A3SG	LO-1A4SG	LO-1A4SGFS	LO-1A5SGFS	LO-1A6SG
	QC QUALIFIER		Field Blank				Field Duplicate	Field Duplicate	
	PROBE DEPTH	36	NA	18	18	18	20	34	18
ANALYTE	MDL								
1,1,1-Trichloroethane	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
1,2-Dichloroethane	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Toluene	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Trichloroethene	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Xylenes (Total)	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
cis-1,2-Dichloroethene	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
trans-1,2-Dichloroethene	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Field HNu Reading	.....	0	0	0	0	0	0	0	0

Notes:

(1) All results are in ppmV.
(2) Positive detections are enclosed in square brackets.
(3) MDL = Method detection limits achieved by laboratory. All MDLs are based on a sample volume of 25 L, except for the MDLs for sample LO-1C1SG which were adjusted for a sample volume of 29.4L.
(4) NA = Not applicable.
(5) R = Unusable.

TABLE 3-1

LENZ OIL
SOIL GAS INVESTIGATION SAMPLING RESULTS

	SAMPLE I.D.	LO-1A7SG	LO-1A8SG	LO-1A8SGMS	LO-1A8GMSD	LO-1A9SG	LO-1B1SG	LO-1B2SG	LO-1B3SG
	QC QUALIFIER			Matrix Spike	Matrix Spike Duplicate				
	PROBE DEPTH	35	28	30	30	36	18	18	16
ANALYTE	MDL								
1,1,1-Trichloroethane	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
1,2-Dichloroethane	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Toluene	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Trichloroethene	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Xylenes (Total)	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
cis-1,2-Dichloroethene	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
trans-1,2-Dichloroethene	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Field HNu Reading	-----	0	0	0	0	0	0	0	0

Notes:

(1) All results are in ppmV.
(2) Positive detections are enclosed in square brackets.
(3) MDL = Method detection limits achieved by laboratory. All MDLs are based on a sample volume of 25 L, except for the MDLs for sample LO-1C1SG which were adjusted for a sample volume of 29.4L.
(4) NA = Not applicable.
(5) R = Unusable.

TABLE 3-1

LENZ OIL
SOIL GAS INVESTIGATION SAMPLING RESULTS

	SAMPLE I.D.	LO-1B4SG	LO-1B5SG	LO-1B6SG	LO-1B7SG	LO-1B8SG	LO-1B8SGFB	LO-1B8SGMS	LO-1B8SGMSD
	QC QUALIFIER						Field Blank	Matrix Spike	Matrix Spike Duplicate
	PROBE DEPTH	18	18	18	18	18	18	18	18
ANALYTE	MDL								
1,1,1-Trichloroethane	0.04	<0.04	<0.04	<0.04	[0.05]	<0.04	<0.04	<0.04	<0.04
1,2-Dichloroethane	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Toluene	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Trichloroethene	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Xylenes (Total)	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
cis-1,2-Dichloroethene	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
trans-1,2-dichloroethene	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Field HNU Reading	-----	0	0	0	0	0	0	0	0

Notes:

(1) All results are in ppmV.
(2) Positive detections are enclosed in square brackets.
(3) MDL = Method detection limits achieved by laboratory. All MDLs are based on a sample volume of 25 L, except for the MDLs for sample LO-1C1SG which were adjusted for a sample volume of 29.4L.
(4) NA = Not applicable.
(5) R = Unusable.

TABLE 3-1

LENZ OIL
SOIL GAS INVESTIGATION SAMPLING RESULTS

	SAMPLE I.D.	LO-1B9SG	LO-1B9SGFB	LO-1C1SG	LO-1C1SGFB	LO-1C2SG	LO-1C3SG	LO-1C4SG	LO-1C4SGFB
	QC QUALIFIER		Field Blank		Field Blank				Field Blank
	PROBE DEPTH	19	18	18	18	18	18	18	18
ANALYTE	MDL								
1,1,1-Trichloroethane	0.04	<0.04	<0.04	<0.03	<0.04R	<0.04	<0.04	<0.04	<0.04
1,2-Dichloroethane	0.05	[0.23]	<0.05	<0.04	<0.05R	<0.05	<0.05	<0.05	<0.05
Toluene	0.06	<0.06	<0.06	<0.05	<0.06R	<0.06	<0.06	<0.06	<0.06
Trichloroethene	0.04	[0.10]	<0.04	<0.03	<0.04R	<0.04	<0.04	<0.04	<0.04
Xylenes (Total)	0.05	<0.05	<0.05	<0.04	<0.05R	<0.05	<0.05	<0.05	<0.05
cis-1,2-Dichloroethene	0.05	<0.05	<0.05	<0.04	<0.05R	<0.05	<0.05	<0.05	<0.05
trans-1,2-Dichloroethene	0.10	<0.10	<0.10	<0.08	<0.10R	<0.10	<0.10	<0.10	<0.10
Field Hnu Reading	.....	0	0	0	0	0	0	0	0

Notes:

(1) All results are in ppmV.
(2) Positive detections are enclosed in square brackets.
(3) MDL = Method detection limits achieved by laboratory. All MDLs are based on a sample volume of 25 L, except for the MDLs for sample LO-1C1SG which were adjusted for a sample volume of 29.4L.
(4) NA = Not applicable.
(5) R = Unusable.

TABLE 3-1

LENZ OIL
SOIL GAS INVESTIGATION SAMPLING RESULTS

	SAMPLE I.D.	LO-1C5SG	LO-1C6SG	LO-1C6SGFS	LO-1C7SG	LO-1C8SG	LO-1C9SG	LO-1C10SG	LO-1C10SGFD
	QC QUALIFIER			Field Duplicate					Field Duplicate
	PROBE DEPTH	18	18	18	18	18	18	18	18
ANALYTE	MDL								
1,1,1-Trichloroethane	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
1,2-Dichloroethane	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Toluene	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Trichloroethene	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Xylenes (Total)	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
cis-1,2-Dichloroethene	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
trans-1,2-Dichloroethene	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Field HNu Reading	-----	0	0	0	0	0	0	0	0

Notes:

(1) All results are in ppmV.
(2) Positive detections are enclosed in square brackets.
(3) MDL = Method detection limits achieved by laboratory. All MDLs are based on a sample volume of 25 L, except for the MDLs for sample LO-1C1SG which were adjusted for a sample volume of 29.4L.
(4) NA = Not applicable.
(5) R = Unusable.

TABLE 3-1

LENZ OIL
SOIL GAS INVESTIGATION SAMPLING RESULTS

	SAMPLE I.D.	LO-1C10SGFB	LO-1C11SG	LO-1C12SG	LO-1C13SG	LO-1CD14SG	LO-1A1SGTB1	LO-1SGTB2	LO-1SGTB3
	QC QUALIFIER	Field Blank					Trip Blank	Trip Blank	Trip Blank
	PROBE DEPTH	18	18	18	18	18	18	18	18
ANALYTE	MDL								
1,1,1-Trichloroethane	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
1,2-Dichloroethane	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Toluene	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Trichloroethene	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Xylenes (Total)	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
cis-1,2-Dichloroethene	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
trans-1,2-Dichloroethene	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Field HNu Reading	-----	0	0	0	0	0	NA	NA	NA

Notes:

(1) All results are in ppmV.
(2) Positive detections are enclosed in square brackets.
(3) MDL = Method detection limits achieved by laboratory. All MDLs are based on a sample volume of 25 L, except for the MDLs for sample LO-1C1SG which were adjusted for a sample volume of 29.4L.
(4) NA = Not applicable.
(5) R = Unusable.

TABLE 3-1

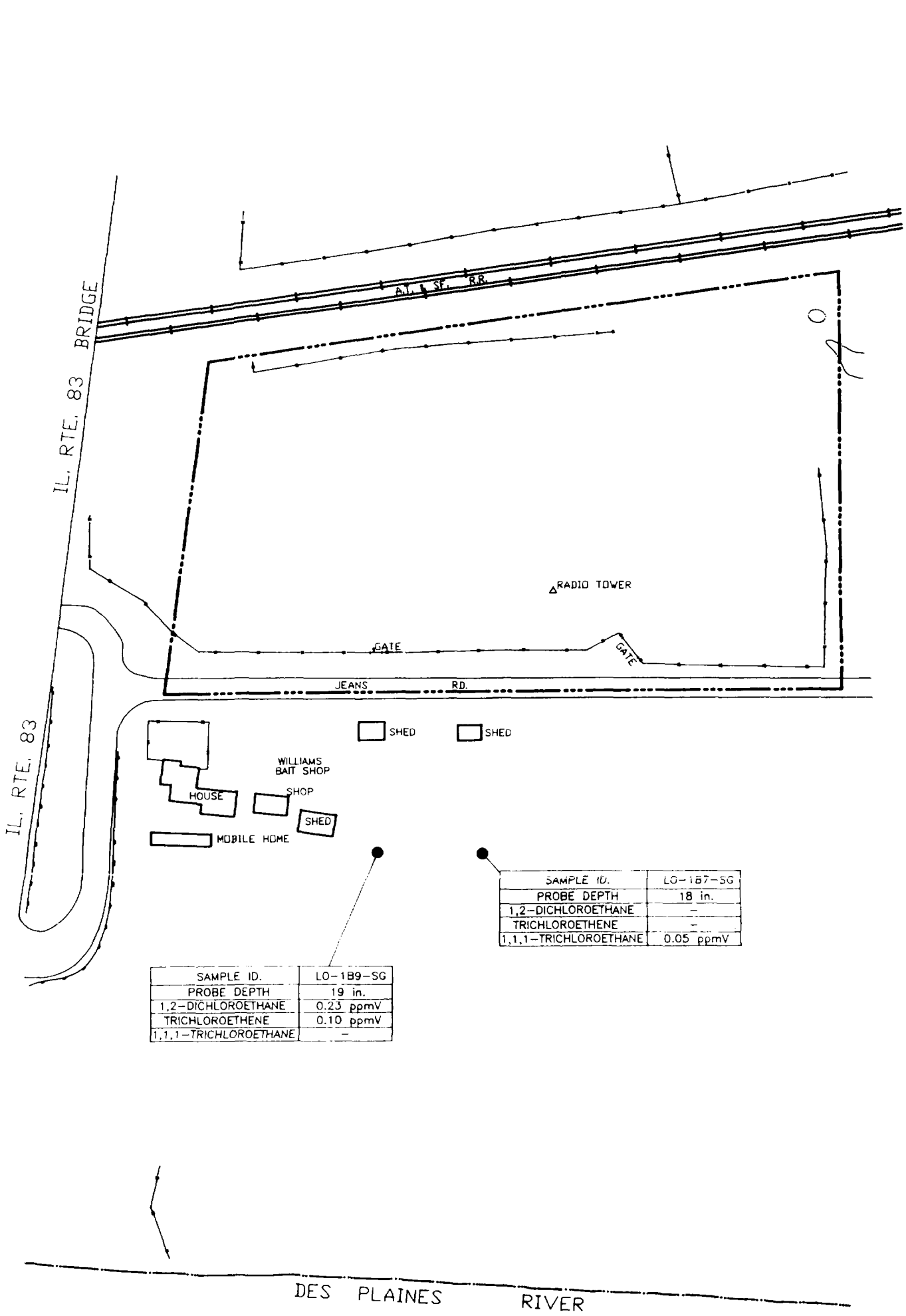
LENZ OIL
SOIL GAS INVESTIGATION SAMPLING RESULTS

	SAMPLE I.D.	LO-1SGTB4	LO-1SGTB5						
	QC QUALIFIER	Trip Blank	Trip Blank						
	PROBE DEPTH	18	18						
ANALYTE	MDL								
1,1,1-Trichloroethane	0.04	<0.04	<0.04						
1,2-Dichloroethane	0.05	<0.05	<0.05						
Toluene	0.06	<0.06	<0.06						
Trichloroethene	0.04	<0.04	<0.04						
Xylenes (Total)	0.05	<0.05	<0.05						
cis-1,2-Dichloroethene	0.05	<0.05	<0.05						
trans-1,2-Dichloroethene	0.10	<0.10	<0.10						
Field HNu Reading	-----	NA	NA						

Notes:

(1) All results are in ppmV.
(2) Positive detections are enclosed in square brackets.
(3) MDL = Method detection limits achieved by laboratory. All MDLs are based on a sample volume of 25 L, except for the MDLs for sample LO-1C1SG which were adjusted for a sample volume of 29.4L.
(4) NA = Not applicable.
(5) R = Unusable.

PROJECT:	REPORT:	DRAWN	CHECKED	DATE:	APPROVED	CLIENT NAME:
0252	TM2	GW		4/29/91		LENZ OIL



SAMPLE ID.	LO-1B9-SG
PROBE DEPTH	19 in.
1,2-DICHLOROETHANE	0.23 ppmV
TRICHLOROETHENE	0.10 ppmV
1,1,1-TRICHLOROETHANE	–

SAMPLE ID.	LO-1B7-SG
PROBE DEPTH	18 in.
1,2-DICHLOROETHANE	–
TRICHLOROETHENE	–
1,1,1-TRICHLOROETHANE	0.05 ppmV

APPROX. SCALE (ft.)
0 120

SYMBOL LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD
- SOIL GAS SAMPLE LOCATION WITH IDENTIFIED CONTAMINATION
- – COMPOUND NOT DETECTED
- WATER SURFACE

FIGURE 3-1

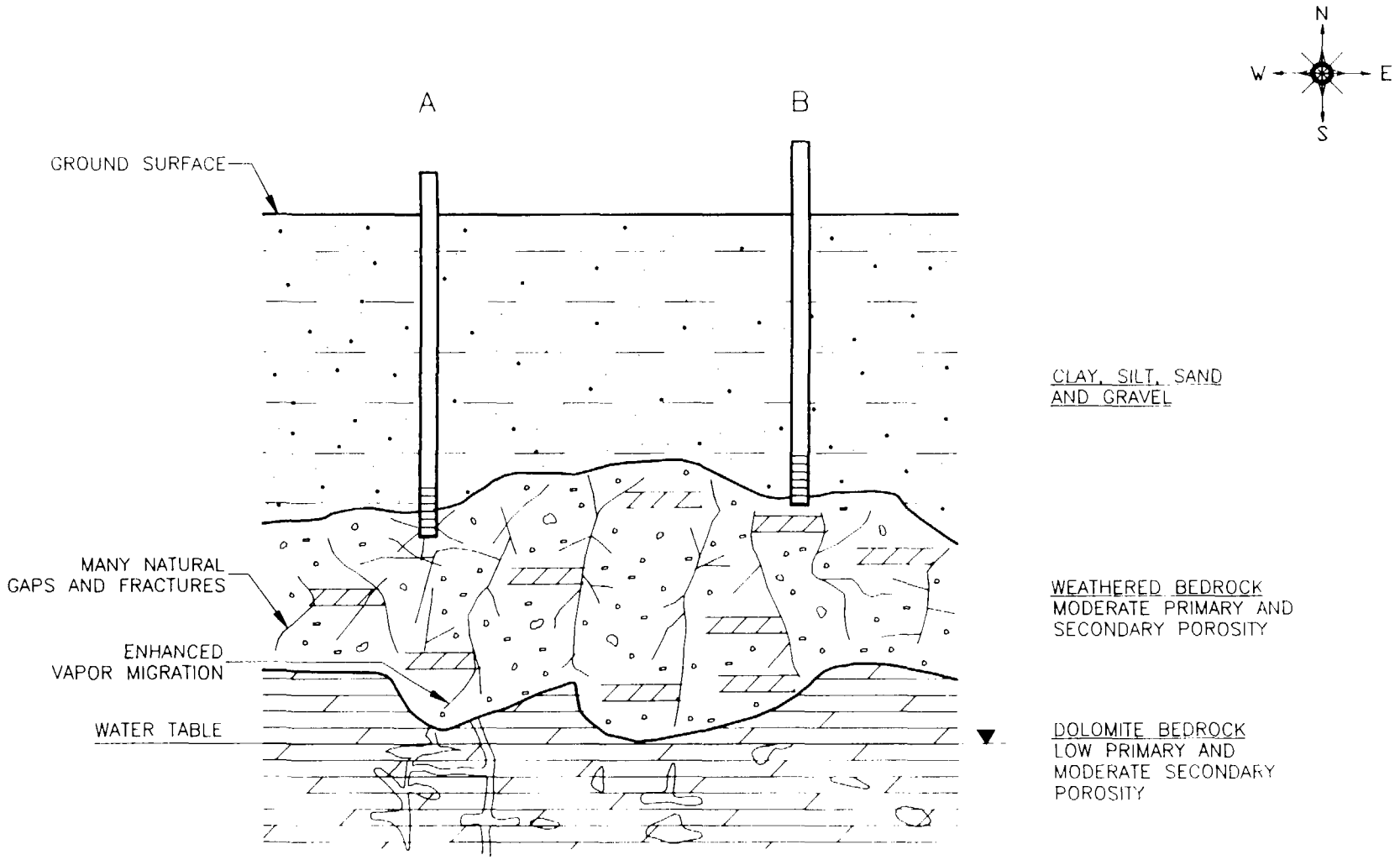
SOIL GAS INVESTIGATION SAMPLING RESULTS LENZ OIL SITE

ERM

2. As illustrated in the generalized geologic section (Figure 3-2), the shallow bedrock aquifer at the site is anisotropic, consisting of a fractured dolomite with low primary porosity and relatively high secondary porosity. The secondary porosity has developed preferentially alone vertical joints and horizontal bedding planes in the dolomite. As a result, soil gas contaminants may be unevenly distributed above the plume. Therefore, sampling points located directly above vertical joints, and the resultant solution cavities, are more likely to exhibit positive detects from the ground water plume than those positioned above unfractured dolomite. As shown on Figure 3-2, migration of volatile contaminants from the aquifer is enhanced by the presence of vertical fractures and solution cavities in the dolomite (i.e., below sample point A). Whereas bedrock without extensive fracturing and solution cavities does not readily allow migration of equivalent quantities of volatile contaminants (i.e., below sample point B).

3. There is no way to determine which specific sample points may have intercepted vertical fractures connected to the ground water, but it is assumed that the density of the sampling grid provided adequate data to effectively evaluate plume migration, given the geologic constraints described above.

PROJECT	REPORT	DRAWN	CHECKED	DATE	APPROVED	CLIENT NAME
0252	TM2	MO		4/30/91		LENZ OIL



NOT DRAWN TO SCALE

FIGURE 3-2

GENERALIZED GEOLOGIC CONDITIONS CONTROLLING SOIL GAS SAMPLING LENZ OIL SITE

ERM

It is important to note that the two analytical samples with positive detections are located on the same east-west grid line, within 100 feet of each other (see Figure 3-1). If the soil gas collected at these locations can be attributed solely to ground water contamination, then the analytical results suggest that the contaminant plume has migrated at least 200 feet southeast of the Lenz Oil site.

4.0 CONCLUSIONS

Based on the Soil Gas Investigation results, the following general conclusions can be made:

1. Soil gas samples collected south of the Lenz Oil site generally showed no detectable concentrations of the VOCs analyzed. Only two of the 32 investigative samples showed positive detections, both at concentrations less than 0.5 ppmV.

2. If the two positive detections are related solely to ground water contamination, then the plume has migrated at least 200 feet southeast of the site. The three contaminants identified in soil gas samples are:

   - 1,1,1-trichloroethane,
   - 1,2-dichloroethane, and
   - trichloroethene.

   These compounds were found in the primary contaminant sources identified at the Lenz Oil site and in the area soils, as documented in Technical Memorandum No. 1.

3. The distribution of the identified soil gas contamination is consistent with the previously predicted southeastern flow direction of ground water at the site. Soil gas samples were not collected

from the area northeast of the site; therefore, the extent of plume migration was not evaluated in that direction using soil gas.

4. The low concentrations and limited detections of VOCs in the soil gas samples may be indicative of (1) anisotropy in the bedrock aquifer and/or (2) low concentrations of ground water contamination near the distal portions of the ground water plume.

5. The Soil Gas Investigation results can be used, in conjunction with the fracture analysis and previous investigation results, to guide the location of monitoring wells to be installed southeast of the Lenz Oil site.

5.0 MODIFICATIONS TO MONITORING WELL LOCATIONS

As described in Technical Memorandum No. 1, the results of the regional bedrock fracture analyses conducted in the vicinity of the site demonstrate that the monitoring well locations and depths proposed in the Lenz Oil RI/FS Work Plan are sufficient to meet the objectives of the ground water investigation. Therefore, none of the preliminary monitoring well locations or depths have been modified as a result of the regional fracture analysis.

However, because contamination was detected in two soil gas samples, located approximately 100 feet southeast of monitoring well cluster G-102, two of the preliminary monitoring well cluster locations should be modified to better delineate the southeastern extent of ground water contamination. Specifically, monitoring well clusters MW-03 and MW-06 should be located further southeast of the site than the preliminary locations. To avoid interfering with potential agricultural activities in the field southeast of the Lenz Oil site, ERM-North Central proposes relocating monitoring well clusters MW-03 and MW-06 on southeast edge of the Williams field at the locations shown on Figure 5-1. These wells will serve to evaluate the southeastern extent of the ground water contaminant plume.

In Revision O of this Technical Memorandum, it was proposed that monitoring well cluster MW-02 be located approximately 200 feet southeast of its preliminary location. The rationale for the proposed change was presented in the Technical Memorandum and expanded in a letter to USEPA, dated March 25, 1991. USEPA and IEPA rejected the proposal in letters dated February 21, 1991, April 1, 1991, and in a telephone conversation dated April 15, 1991. Although the preliminary location of MW-02 presented in the Work Plan may be too close to the probable source area to meet its stated objectives, the participating respondents have agreed to install MW-02 at the location presented in the Work Plan. According to USEPA and IEPA,

PROJECT:	REPORT:	DRAWN	CHECKED	DATED	APPROVED	CLIENT NAME:
0252	TM2	GW		4/29/91		LENZ OIL

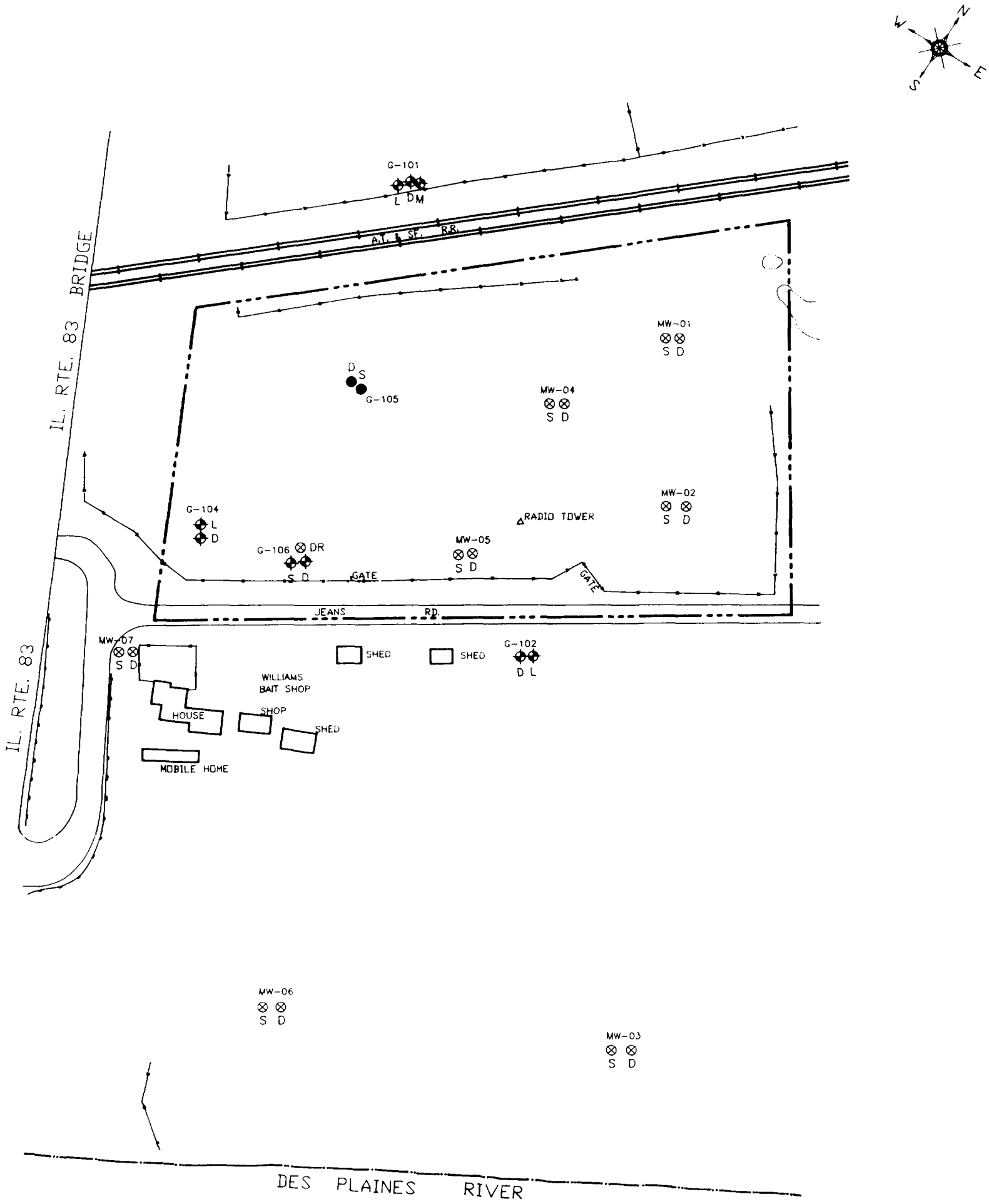


FIGURE 5-1

PROPOSED GROUND WATER SAMPLE LOCATIONS LENZ OIL SITE

ERM

the purpose of installing the well cluster at that location is to verify the presence of any contaminant plume in that area.

The preliminary locations of well clusters MW-01, MW-04, MW-05 and MW-07 meet the stated objectives of these wells and, therefore, modification of these preliminary locations is not necessary. The southwestern extent of the plume will be evaluated by well cluster MW-07 and the northeastern extent of the plume will be evaluated by well cluster MW-01. Well clusters MW-04 and MW-05 will assist in determining the type and magnitude of ground water contamination near the probable contaminant source.

REFERENCES

ERM-North Central, Inc., Remedial Investigation/Feasibility Study Sampling and Analysis Plan, Lenz Oil Service, Inc., Lemont, Illinois, November 12, 1990.

ERM-North Central, Inc., Remedial Investigation/Feasibility Study Work Plan, Lenz Oil Service, Inc., Lemont, Illinois, November 12, 1990.

ERM-North Central, Inc., Remedial Investigation/Feasibility Study Quality Assurance Project Plan, Lenz Oil Service, Inc., Lemont, Illinois, November 12, 1990.

APPENDIX A

SOIL GAS DATA VALIDATION

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

This appendix presents the data validation results for laboratory analytical data generated during the Soil Gas Investigation conducted as Phase I, Task 1 of the Remedial Investigation/ Feasibility Study (RI/FS) for the Lenz Oil site. The investigation was performed in January 1991, and involved the collection of soil gas samples from 32 locations, downgradient from the Lenz Oil site. Two matrix spike/matrix spike duplicates (MS/MSD), four field duplicates, five field blanks, and five trip blanks were collected for Quality Assurance/Quality Control (QA/QC) purposes. All samples were shipped to PACE Laboratories, Inc. in Minnesota, and were analyzed for 1,1,1-trichloroethane, 1,2-dichloroethane, toluene, trichloroethene, xylenes (total), and cis- and trans-1,2-dichloroethene.

The data validation was conducted in accordance with the procedures contained in Appendix I of the Lenz Oil RI/FS Quality Assurance Project Plan (QAPP), the Standard Operating Procedure for Soil Gas Data Validation. No QC criteria exceeded the control limits were identified, except for sample LO-1C1-SGFB. Because no internal standard was injected, the analytical results for this sample are qualified unusable (R). No qualification was necessary for the other analytical data, which are considered acceptable.

2.0 DATA VALIDATION SUMMARY

The following subsections itemize each aspect of the data validation procedure according to Appendix I of the QAPP.

2.1 Holding Times

All sample tubes were analyzed within 7 days from the date of collection, except for the MS/MSD duplicate pair associated with sample LO-1B8-SG (PACE Nos. 1232.7MS and 1233.5MSD), which were collected on January 12, 1991 and analyzed on January 23, 1991 (see Table A-1). The MS/MSD analysis was performed to obtain recovery information for the method. Therefore, the holding times do not affect the quality of the data.

No qualification of these data is necessary.

2.2 Blanks

None of the target compounds were detected in either the field or the trip blanks. In addition, the laboratory method blanks, which consisted of an aliquot of carbon disulfide spiked with surrogate (decane) and internal standard (bromofluorobenzene) compounds did not contain any analytes on the target list above the method detection limits.

No qualification of these data is necessary.

2.3 Instrument Calibration

2.3.1 Initial Calibration

The percent Relative Standard Deviation (% RSD) for all analytes, and for each set of analyses conducted was less than the QC control limits of 30 percent.

TABLE A-1

EVALUATION OF SAMPLE HOLDING TIMES

	SAMPLE ID.	QA/AC QUALIFIER	DATE		
			COLLECTED	RECEIVED	ANALYZED
1	LO-1-A1SG		1/09/91	1/10/91	1/15/91
2	LO-1-A1SG-FB	Field Blank	1/09/91	1/10/91	1/15/91
3	LO-1-A1SG-TB1	Trip Blank	1/09/91	1/10/91	1/15/91
4	LO-1-A2SG		1/10/91	1/12/91	1/15/91
5	LO-1A3SG		1/10/91	1/12/91	1/15/91
6	LO-1A4SG		1/10/91	1/12/91	1/15/91
7	LO-1A4SG-FS	Field Duplicate	1/10/91	1/12/91	1/15/91
8	LO-1A5SG		1/10/91	1/12/91	1/15/91
9	LO-1A6SG		1/10/91	1/12/91	1/15/91
10	LO-1A7SG		1/10/91	1/12/91	1/15/91
11	LO-1A8SG		1/10/91	1/12/91	1/15/91
12	LO-1A8SG-MS	Matrix Spike	1/10/91	1/12/91	1/15/91
13	LO-1A8SG-MSD	Matrix Spike Duplicate	1/10/91	1/12/91	1/15/91

Notes:

(1) - Samples are presented in the order of collection.

TABLE A-1

EVALUATION OF SAMPLE HOLDING TIMES

	SAMPLE ID.	QA/AC QUALIFIER	DATE		
			COLLECTED	RECEIVED	ANALYZED
14	LO-1A9SG		1/10/91	1/12/91	1/15/91
15	LO-1B9SG		1/10/91	1/12/91	1/15/91
16	LO-1B9SG-FB	Field Blank	1/10/91	1/12/91	1/15/91
17	LO-1SG-TB2	Trip Blank	1/10/91	1/12/91	1/15/91
18	LO-1B1SG		1/11/91	1/12/91	1/16/91
19	LO-1B2SG		1/11/91	1/12/91	1/16/91
20	LO-1B3SG		1/11/91	1/12/91	1/16/91
21	LO-1B4SG		1/11/91	1/12/91	1/16/91
22	LO-1B5SG		1/11/91	1/12/91	1/16/91
23	LO-1B6SG		1/11/91	1/12/91	1/16/91
24	LO-1B7SG		1/11/91	1/12/91	1/16/91
25	LO-1C1SG-FB	Field Blank	1/11/91	1/12/91	1/16/91
26	LO-1C1SG		1/11/91	1/12/91	1/16/91

Notes:

(1) - Samples are presented in the order of collection.

TABLE A-1

EVALUATION OF SAMPLE HOLDING TIMES

	SAMPLE ID.	QA/AC QUALIFIER	DATE		
			COLLECTED	RECEIVED	ANALYZED
27	LO-1C4SG-FS	Field Duplicate	1/1191	1/12/91	1/16/91
28	LO-1C4SG		1/11/91	1/12/91	1/16/91
29	LO-1C5SG		1/11/91	1/12/91	1/16/91
30	LO-1SG-TB3	Trip Blank	1/11/91	1/12/91	1/16/91
31	LO-1C2SG		1/12/91	1/14/91	1/19/91
32	LO-1C3SG		1/12/91	1/14/91	1/19/91
33	LO-1C6SG		1/12/91	1/14/91	1/19/91
34	LO-1C6SG-FS	Field Duplicate	1/12/91	1/14/91	1/19/91
35	LO-1B8SG-FB	Field Blank	1/12/91	1/14/91	1/19/91
36	LO-1B8SG		1/12/91	1/14/91	1/19/91
37	LO-1B8SG-MS	Matrix Spike	1/12/91	1/14/91	1/23/91
38	LO-1B8SG-MSD	Matrix Spike Duplicate	1/12/91	1/14/91	1/23/91
39	LO-1SG-TB4	Trip Blank	1/12/91	1/14/91	1/19/91

Notes:

(1) - Samples are presented in the order of collection.

TABLE A-1

EVALUATION OF SAMPLE HOLDING TIMES

	SAMPLE ID.	QA/AC QUALIFIER	DATE		
			COLLECTED	RECEIVED	ANALYZED
40	LO-1C7SG		1/14/91	1/15/91	1/19/91
41	LO-1C8SG		1/14/91	1/15/91	1/19/91
42	LO-1C9SG		1/14/91	1/15/91	1/19/91
43	LO-1C10SG		1/14/91	1/15/91	1/19/91
44	LO-1C10SG-FB	Field Blank	1/14/91	1/15/91	1/19/91
45	LO-1C10SG-FD	Field Duplicate	1/14/91	1/15/91	1/20/91
46	LO-1C11SG		1/14/91	1/15/91	1/20/91
47	LO-1C12SG		1/14/91	1/15/91	1/20/91
48	LO-1C13SG		1/14/91	1/15/91	1/20/91
49	LO-1CP14SG		1/14/91	1/15/91	1/20/91
50	LO-1SG-TB5	Trip Blank	1/14/91	1/15/91	1/20/91

Notes:

(1) - Samples are presented in the order of collection.

No qualification of these data is necessary.

2.3.2 Continuing Calibration

The percent Difference (% D) for all analytes and for each set of analyses conducted was less than the QC limit of 25 percent.

No qualification of these data is necessary.

2.4 Surrogate Spike Recovery

All surrogate (decane) spike recoveries for each sample analyzed were within the QC limits of 75 to 125 percent.

No qualification of these data is necessary.

2.5 Internal Standard Areas

All internal standard areas were within the QC control limits of 50 to 200 percent as compared to the associated calibration standard, except for sample LO-1C1-SGFB (PACE No. 1070.7 - primary-front), which was not injected with the internal standard. The laboratory-reported results for this sample were taken from a confirmation column by using external calibration. Therefore, the analytical results for this sample are qualified as unusable (R).

Also, sample LO-1C13-SG (PACE No. 1342.2 - primary-front) was injected with double the required concentration of the internal standard (20 μg/L instead of 10 μg/L). This resulted in double the internal standard area. If this area is divided by two, the reported value is within the QC control limits.

No qualification of the data is necessary.

2.6 Matrix Spike/Matrix Spike Duplicates

Two MS/MSD sample pairs corresponding to native samples LO-1A8-SG and LO-1B8-SG were collected as part of the Soil Gas Investigation. As noted previously in Section 2.1 of this appendix, the MS/MSD pair for sample LO-1B8-SG were not analyzed until 11 days after sample collection. The primary tubes had been extracted and analyzed 7 days after collection, but not as an MS/MSD pair. Because of some evaporation of carbon disulfide, the recoveries were high, and were considered to give erroneous information. Therefore, the secondary tubes were analyzed.

Matrix spike recoveries for both MS/MSD pairs (LO-1A8-SGMS/MSD and LO-1B8-SGMS/MSD) were within the QC control limits of 75 to 125 percent. The calculated RPD for each pair of spike recoveries were was within the QC control limits of $\pm$20 percent.

Therefore, no qualification of the native unspiked sample results (LO-1A8-SG and LO-1B8-SG) is necessary.

2.7 Field Duplicates

As noted previously, four field duplicates were collected. The analytical results for these samples and their corresponding native samples are all below detection limits. Therefore, percent differences cannot be calculated, and no qualification of these data is necessary.

3.0 MISCELLANEOUS

All the raw laboratory data were obtained from PACE Laboratory, Inc. These included chromatograms, equipment calibration, and other data. The following subsections present examination results of chromatograms, spot checks of calculations, and other data deliverables.

3.1 Chromatograms

The chromatograms for all sample injections were checked, and the retention times for all compounds were consistent with the laboratory standards. Compound concentrations were determined by using the correct QC standard values and areas.

False readings for trans-1,2-dichloroethene were discovered on chromatogram columns DB-5 and DB-1701. This problem was caused by coelution with carbon disulfide. Another column identified as DB-Wax was used to separate the two compounds; and all samples, blanks, and standards were also analyzed on this column for the sole reason of qualifying the trans-1,2-dichloroethene concentration.

3.2 Calculation Checks

Summaries of the laboratory analytical results were spot checked. These spot checks of contaminant concentrations were performed by using the reported chromatogram areas of selected samples and QC standards.

No errors in the calculations or in data transcriptions were discovered.

3.3 Data Deliverables

PACE Laboratories has submitted all data deliverables according to Appendices B and I of the Lenz Oil QAPP, PACE Standard Operating Procedures, and Standard Operating Procedure for Soil Gas Data Validation, respectively.

4.0 CONCLUSIONS

The results and discussion presented in this appendix show that the laboratory analytical results for the Lenz Oil Soil Gas Investigation samples do not exhibit any anomalies. Therefore, the data are considered acceptable.

APPENDIX B

SOIL GAS - LABORATORY ANALYTICAL RESULTS AND SUPPORTING QC DOCUMENTATION

REPORT OF LABORATORY ANALYSIS

ERM - North Central, Inc.
102 Wilmot Road
Suite 300
Deerfield, IL 60015

January 18, 1991
PACE Project
Number: 910110505

Attn: Mr. Dave Edwards

Lenz Oil LO1991A

PACE Sample Number:			10 0007382	10 0007390	10 0007404
Date Collected:			01/09/91	01/09/91	01/09/91
Date Received:			01/10/91	01/10/91	01/10/91
			LO-1A1-	LO-1A1-	LO-1A1-
Parameter	Units	MDL	SG	SGFB	SGTB1
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my supervision.

James J. Matteson
FOR
Liesa A. Shanahan
Organic Chemistry Manager

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3377

PACE, Inc.
Soil Gas Analysis QC Sheet

Client Name: ERM - [illegible]
Project Name: [illegible]
PACE Project Number: 910110505

Instrument ID: 8
Primary Column ID: [illegible]

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Surrogate Recovery Decane (%)
7[illegible]	Prime	Front	1/15/91	114
		Back		124
7[illegible]2		Front		114
		Back		124
7[illegible]4		Front		118
		Back		99
[illegible]	—		1/15/91	~7

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Surrogate Recovery Decane (%)

rogate QC Limits
- 75%-125%.

Comments

PACE, Inc.
Soil Gas Analysis QC Sheet

Client Name: [illegible]
Project Name: [illegible]
PACE Project Number: [illegible]

Instrument ID: 5
Primary Column ID: [illegible]

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Matrix Spike Recovery (%) 1	2	3	4	5	6
~~5 c spike~~	—		[illegible]	80	93	94	93	94	94

Matrix Spike QC Limits are 75%-125%.

1 = cis-1,2-Dichloroethene
2 = 1,1,1-Trichloroethane
3 = Trichloroethene
4 = Toluene
5 = m,p-Xylene
6 = ~~p-Xylene~~ o-xylene

Comments

PACE, Inc.
Soil Gas Analysis QC Sheet
Method Blank Summary

Client Name: ERM - West entrance
Project Name: Lenz Oil
PACE Project Number: 1010505

Instrument ID: 3
Primary Column ID: 5-meter, 0.32 mm ID
Supelco DB-5

Date Analyzed	Target Compounds
11/5/01	None found

Comments:

PACE, Inc.
Soil Gas Analysis Calibration Summary

Client Name: ERM - North Central
Project Name: [illegible]
PACE Project Number: 910110 505

Instrument ID: B
Primary Column ID:
Analysis Date: 30 meter, 0.32 mm ID Supelco DB [illegible]

Initial Calibration Summary

Analytes	Standards (ug/ml) 5	10	50	100	500	AVE.	%RSD
cis-1, 2-Dichloroethene	0.401	0.470	0.575	0.578	0.577	0.520	16
trans-1, 2-dichloroethene	6.39x10^-4	6.1[illegible]x10^-4	6.33x10^-4	5.98x10^-4	6.18x10^-4	6.2[illegible]x10^-4	3
1, 2-Dichloroethane	0.271	0.388	0.518	0.561	0.579	0.465	29
Trichloroethene	0.347	0.395	0.453	0.463	0.461	0.424	12
1, 1, 1-Trichloroethane	0.446	0.446	0.469	0.458	0.446	0.453	2
Toluene	2.04	2.14	2.37	2.24	2.26	2.22	6
m, p-Xylene (Total) (MEB 11/8/91)	~~[illegible]~~ 2.22	2.24	2.40	2.33	2.31	2.30	3
o-Xylene	2.22	2.21	2.39	2.32	2.31	2.29	3
Decane (SS)	2.17	2.16	2.29	2.20	2.20	2.20	2

Continuing Calibration Summary

Analytes	Analysis Date	Standard ug	% Diff.	Analysis Date	Standard	% Diff.
cis-1, 2-Dichloroethene	11/15/91	45	10			
trans-1, 2-dichloroethene	↓	11	17			
1, 2-Dichloroethane	11/17/91	47	5			
Trichloroethene	11/15/91	45	11			
1, 1, 1-Trichloroethane	│	46	5			
Toluene	│	45	7			
m, p-Xylene (Total)	│	48	3			
o-Xylene	↓	50	3			
Decane (SS)						

Comments: 1) TRANS-1,2 DICHLOROETHANE WAS RUN ON A SINGLE COLUMN - SUPELCO DB-WAX, 30 meters, 0.25 micron film thickness

2) TRANS-1,2 DICHLOROETHANE WAS CALIBRATED WITH STANDARDS OF 10 ug/ml, 25, 50, 100, & 500

REPORT OF LABORATORY ANALYSIS

ERM - North Central, Inc.
102 Wilmot Road
Suite 300
Deerfield, IL 60015

January 18, 1991
PACE Project
Number: 910112502

Attn: Mr. Dave Edwards

0252JI Lenz Oil

PACE Sample Number:			10 0010502	10 0010510	10 0010529
Date Collected:			01/10/91	01/10/91	01/10/91
Date Received:			01/12/91	01/12/91	01/12/91
Parameter	Units	MDL	LO-1A2-SG	LO-1A3-SG	LO-1A4-SG
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612 525-3377

Mr. Dave Edwards
Page 2

January 18, 1991
PACE Project
Number: 910112502

0252JI Lenz Oil

Parameter	Units	MDL	10 0010537 01/10/91 01/12/91 LO-1A4- SGFS	10 0010545 01/10/91 01/12/91 LO-1A5- SG	10 0010553 01/10/91 01/12/91 LO-1A7- SG
PACE Sample Number:					
Date Collected:					
Date Received:					
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	0.12	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

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Minneapolis, MN 55422
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Mr. Dave Edwards
Page 3

January 18, 1991
PACE Project
Number: 910112502

0252JI Lenz Oil

Parameter	Units	MDL	10 0010561 01/10/91 01/12/91 LO-1A6-SG	10 0010570 01/10/91 01/12/91 LO-1A8-SG	10 0010588 01/10/91 01/12/91 LO-1A8-SGMS (MS/MSD)
PACE Sample Number:					
Date Collected:					
Date Received:					
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

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Mr. Dave Edwards
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January 18, 1991
PACE Project
Number: 910112502

0252JI Lenz Oil

PACE Sample Number:			10 0010596	10 0010600	10 0010618
Date Collected:			01/10/91	01/10/91	01/10/91
Date Received:			01/12/91	01/12/91	01/12/91
			LO-1A9-	LO-1B9-	LO-1B9-
Parameter	Units	MDL	SG	SG	SGFB
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	0.23	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	0.10	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

1710 Douglas Drive North
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pace INCORPORATED

REPORT OF LABORATORY ANALYSIS

Mr. Dave Edwards
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January 18, 1991
PACE Project
Number: 910112502

0252JI Lenz Oil

PACE Sample Number:			10 0010626
Date Collected:			01/10/91
Date Received:			01/12/91
			LO-1-
Parameter	Units	MDL	SGIB2
ORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
1,1,1-Trichloroethane	ppm	0.04	ND
1,2-Dichloroethane	ppm	0.05	ND
Toluene	ppm	0.06	ND
Trichloroethylene	ppm	0.04	ND
Xylene	ppm	0.05	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my supervision.

James J. Matteson
FOR
Liesa A. Shanahan
Organic Chemistry Manager

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PACE, Inc.
Soil Gas Analysis QC Sheet

Client Name: ERM - North Central
Project Name: [illegible]
PACE Project Number: 910112.502

Instrument ID: B
Primary Column ID: [illegible]

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Surrogate Recovery Decane (%)
1052.2	Prime	Front	[illegible]5/91	[illegible]6
		Back		[illegible]5
[illegible]		Front		[illegible]4
		Back		[illegible]6
[illegible]		Front		[illegible]
		Back		[illegible]3
[illegible]7		Front		[illegible]7
		Back		[illegible]2
[illegible]		Front		[illegible]
		Back		[illegible]2
MS-[illegible]		Front		[illegible]4
[illegible]		Front		[illegible]2
		Back		[illegible]4
1056.[illegible]		Front		[illegible]
		Back		[illegible]26
1057.[illegible]		Front		110
		Back		[illegible]3
[illegible]8.8		Front		[illegible]
		Back		[illegible]3
[illegible]59.[illegible]		Front		[illegible]0
	✓	Back	✓	[illegible]2

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Surrogate Recovery Decane (%)
MSD-1058.8	Prime	Front	[illegible]5/91	[illegible]6
1060.0		Front		[illegible]
		Back		[illegible]4
1061.8		Front		[illegible]
		Back		[illegible]
1062.6		Front		[illegible]
	✓	Back		[illegible]
~~[illegible]~~				
QC spike	—	—	✓	[illegible]9

[illegible]ogate QC Limits
[illegible] 75%-125%.

Comments: sample # 1060.0 has interferences present in the chromatogram

PACE, Inc.
Soil Gas Analysis QC Sheet

Client Name: [illegible]
Project Name: [illegible]
PACE Project Number: [illegible]

Instrument ID: 5
Primary Column ID: [illegible]

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Matrix Spike Recovery (%) 1	2	3	4	5	6
MS [illegible]	Prime	Front	4/5/91	102	105	93	100	120	97
MSD [illegible]	Prime	Front	↓	100	99	100	120	121	99
LC [illegible]	—	—	↓	77	87	92	93	95	95

Matrix Spike QC Limits are 75%-125%.

1 = cis-1,2-Dichloroethene
2 = 1,1,1-Trichloroethane
3 = Trichloroethene
4 = Toluene
5 = m,p-Xylene
6 = ~~p-Xylene~~ [illegible]

Comments

PACE, Inc.
Soil Gas Analysis QC Sheet
Method Blank Summary

Client Name: ERM - North Central
Project Name: Lenz Oil
PACE Project Number: 410112.502

Instrument ID: 6
Primary Column ID: 30 meter, 0.32 mm I.D.
Supelco DB-5

Date Analyzed	Target Compounds
[illegible]	none found

Comments:

PACE, Inc.
Soil Gas Analysis Calibration Summary

Client Name: ERM - North Central
Project Name: Jay Oil
PACE Project Number: 910112.502

Instrument ID: B
Primary Column ID:
Analysis Date: 30 meter, 0.32 mm I.D. Supelco DB 5

Initial Calibration Summary

Analytes	Standards (ug/ml) 5	10	50	100	500	AVE.	%RSD
cis-1, 2-Dichloroethene	0.401	0.470	0.575	0.578	0.577	0.520	16
trans-1, 2-dichloroethene	6.39×10^{-4}	6.10×10^{-4}	6.33×10^{-4}	5.94×10^{-4}	6.18×10^{-4}	6.20×10^{-4}	3
1, 2-Dichloroethane	0.271	0.378	0.503	0.561	0.517	0.465	29
Trichloroethene	0.347	0.395	0.453	0.463	0.461	0.424	12
1, 1, 1-Trichloroethane	0.446	0.446	0.469	0.459	0.446	0.453	2
Toluene	2.04	2.14	2.37	2.29	2.26	2.22	6
m, p-Xylene (Total)	~~2.22~~ 2.22	2.24	2.40	2.33	2.31	2.30	3
o-Xylene	2.22	2.21	2.39	2.32	2.31	2.29	3
Decane (SS)	2.17	2.16	2.29	2.20	2.20	2.20	2

Continuing Calibration Summary

Analytes	Analysis Date	Standard ug	% Diff.	Analysis Date	Standard	% Diff.
cis-1, 2-Dichloroethene	11/5/91	45	10			
trans-1, 2-dichloroethene	"	"	7			
1, 2-Dichloroethane	11/6/91	47	5			
Trichloroethene	"	43	11			
1, 1, 1-Trichloroethane		46	8			
Toluene		48	2			
m, p-Xylene (Total)		45	5			
o-Xylene	"	50	5			
Decane (SS)	--					

Comments: 1) TRANS-1,2 DICHLOROETHANE WAS RUN ON A SINGLE COLUMN - SUPELCO DB-WAX, 30 METER, 0.25 micron film thickness

2) TRANS-1,2 DICHLOROETHANE WAS CALIBRATED WITH STANDARDS @ 10 ug/ml, 45, 50, 100, & 500

REPORT OF LABORATORY ANALYSIS

ERM - North Central, Inc.
102 Wilmot Road
Suite 300
Deerfield, IL 60015

January 18, 1991
PACE Project
Number: 910112503

Attn: Mr. Dave Edwards

Lenz Oil 0252JI

PACE Sample Number:			10 0010634	10 0010642	10 0010650
Date Collected:			01/11/91	01/11/91	01/11/91
Date Received:			01/12/91	01/12/91	01/12/91
Parameter	Units	MDL	LO-1B1-SG	LO-1B2-SG	LO-1B3-SG
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

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Mr. Dave Edwards
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January 18, 1991
PACE Project
Number: 910112503

Lenz Oil 0252JI

PACE Sample Number:			10 0010669	10 0010677	10 0010685
Date Collected:			01/11/91	01/11/91	01/11/91
Date Received:			01/12/91	01/12/91	01/12/91
			LO-1B4-SG	LO-1B5-SG	LO-1B6-SG
Parameter	Units	MDL			
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

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Lenz Oil 0252JI

Parameter	Units	MDL	10 0010693 01/11/91 01/12/91 LO-1B7-SG	10 0010707 01/11/91 01/12/91 LO-1C1-SGFB	10 0010715 01/11/91 01/12/91 LO-1C1-SG
PACE Sample Number:					
Date Collected:					
Date Received:					
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.03	-	-	ND
1,1,1-Trichloroethane	ppm	0.04	0.05	ND	-
1,2-Dichloroethane	ppm	0.04	-	-	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	-
Toluene	ppm	0.05	-	-	ND
Toluene	ppm	0.06	ND	ND	-
Trichloroethylene	ppm	0.03	-	-	ND
Trichloroethylene	ppm	0.04	ND	ND	-
Xylene	ppm	0.04	-	-	ND
Xylene	ppm	0.05	ND	ND	-
cis-1,2-Dichloroethylene	ppm	0.04	-	-	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	-
trans-1,2-Dichloroethylene	ppm	0.08	-	-	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	-

MDL Method Detection Limit
ND Not detected at or above the MDL.

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REPORT OF LABORATORY ANALYSIS

Mr. Dave Edwards
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January 18, 1991
PACE Project
Number: 910112503

Lenz Oil 0252JI

PACE Sample Number:			10 0010723	10 0010731	10 0010740
Date Collected:			01/11/91	01/11/91	01/11/91
Date Received:			01/12/91	01/12/91	01/12/91
			LO-1C4-	LO-1C4-	LO-1C5-
Parameter	Units	MDL	SG	SGFS	SG
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

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REPORT OF LABORATORY ANALYSIS

Mr. Dave Edwards
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January 18, 1991
PACE Project
Number: 910112503

Lenz Oil 0252JI

PACE Sample Number:			10 0010758
Date Collected:			01/11/91
Date Received:			01/12/91
			LO-1-
Parameter	Units	MDL	SGTB3
ORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
1,1,1-Trichloroethane	ppm	0.04	ND
1,2-Dichloroethane	ppm	0.05	ND
Toluene	ppm	0.06	ND
Trichloroethylene	ppm	0.04	ND
Xylene	ppm	0.05	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my supervision.

James J. Matteson
FOR
Liesa A. Shanahan
Organic Chemistry Manager

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PACE, Inc.

Soil Gas Analysis QC Sheet

Client Name: ERM North Central
Project Name: Lenz Oil
PACE Project Number: 910112.503

Instrument ID: 8
Primary Column ID: 30 meter, 0.32 mm I.D.
Supelco DB-5

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Surrogate Recovery Decane (%)
CS. Blk	—	—	1/16/91	98
1063.4	Prime	Front		112
		Back		104
1064.2		Front		113
		Back		105
1065.0		Front		111
		Back		123
[illegible]		Front		112
		Back		115
1067.7		Front		109
		Back		107
Q.C. spike	—	—		96
1068.5	Prime	Front		98
		Back		101
1069.3		Front		110
		Back		103
1070.7		Front		110
		Back		105
1071.5		Front		111
		Back		101

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Surrogate Recovery Decane (%)
1072.3	Prime	Front	1/16/91	112
		Back		105
QC spike	—	—		97
1073.1	Prime	Front		112
		Back		102
1073.1	Secondary	Front		114
		Back		120
1074.0	Prime	Front		113
		Back		113
1075.3		Front		103
		Back		102
Q.C. spike	—	—		90

ogate QC Limits
are 75%-125%.

Comments: Sample 1070.7 Primary - Back = Surrogate recovery taken off of confirmation column (DB-1701)

PACE, Inc.
Soil Gas Analysis QC Sheet

Client Name: ERM - North Central
Project Name: Lenz 0.1
PACE Project Number: 910112-503

Instrument ID: 3
Primary Column ID: 30 m x .53 mm DB-5

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Matrix Spike Recovery (%) 1	2	3	4	5	6
QC spike	—	—	1/16/91	98	96	97	94	95	95
QC spike	—	—		98	98	100	95	95	95
QC spike				99	98	98	95	95	95

Matrix Spike QC Limits are 75%-125%.

1 = cis-1,2-Dichloroethene
2 = 1,1,1-Trichloroethane
3 = Trichloroethene
4 = Toluene
5 = m,p-Xylene
6 = p-Xylene

Comments

PACE, Inc.
Soil Gas Analysis QC Sheet
Method Blank Summary

Client Name: ERM - North Central
Project Name: Lenz 01
PACE Project Number: 910112-503

Instrument ID: B
Primary Column ID: 30 meter, 0.32 I.D. Supelco DB-5

Date Analyzed	Target Compounds
1/16/91	none found

Comments:

PACE, Inc.
Soil Gas Analysis Calibration Summary

Client Name: ERM - North Central
Project Name: Lenz O.I
PACE Project Number: 910112.503

Instrument ID: B
Primary Column ID: 30 meter, 0.32 ID DB-5
Analysis Date: 1-15-91

Initial Calibration Summary

Analytes	Standards (ug/ml) 5	10	50	100	500	AVE.	%RSD
cis-1, 2-Dichloroethene	0.401	0.470	0.575	0.577	0.577	0.520	16
trans-1, 2-dichloroethene	6.39x10⁻⁴	6.10x10⁻⁴	6.33x10⁻⁴	7.40x10⁻⁴	8.18x10⁻⁴	6.80x10⁻⁴	8
1, 2-Dichloroethane	0.371	0.388	0.518	0.561	0.589	0.465	29
Trichloroethene	0.347	0.395	0.453	0.463	0.461	0.424	12
1, 1, 1-Trichloroethane	0.446	0.446	0.469	0.453	0.446	0.453	2
Toluene	2.04	2.14	2.37	2.29	2.26	2.22	6
m, p-Xylene (Total)	~~1.47~~ 2.22	2.24	2.42	2.33	2.31	2.30	3
o-Xylene	2.22	2.21	2.34	2.32	2.31	2.29	3
Decane (SS)	2.17	2.16	2.29	2.20	2.20	2.20	2

MRB 1/18/91

Continuing Calibration Summary

Analytes	Analysis Date	Standard ug	% Diff.	Analysis Date	Standard	% Diff.
cis-1, 2-Dichloroethene	1/16/91	44	1			
trans-1, 2-dichloroethene	1/21/91	110	~~15~~ 11			
1, 2-Dichloroethane	1/15/91	46	6			
Trichloroethene	1/16/91	48	3			
1, 1, 1-Trichloroethane	↓	45	1			
Toluene		123	0			
m, p-Xylene (Total)		226	2			
o-Xylene	↓	105	0			
Decane (SS)						

MRB 1/18/91

Comments: 1) TRANS-1,2 DICHLOROETHANE WAS RAN ON A SINGLE COLUMN - SUPELCO DB-WAX, 30 meters, 0.25 micron film thickness

2) TRANS 1,2 DICHLOROETHANE WAS CALIBRATED WITH STANDARDS @ 10 ug/ml, 5, 50, 100, & 500

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REPORT OF LABORATORY ANALYSIS

ERM - North Central, Inc.
102 Wilmot Road
Suite 300
Deerfield, IL 60015

January 21, 1991
PACE Project
Number: 910115501

Attn: Mr. Dave Edwards

0252 JI/Lenz Oil

PACE Sample Number:			10 0012262	10 0012270	10 0012289
Date Collected:			01/12/91	01/12/91	01/12/91
Date Received:			01/14/91	01/14/91	01/14/91
Parameter	Units	MDL	LO-IC2-SG	LO-IC3-SG	LO-IC6-SG
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

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Mr. Dave Edwards
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January 21, 1991
PACE Project
Number: 910115501

0252 JI/Lenz Oil

PACE Sample Number:			10 0012297	10 0012300	10 0012319
Date Collected:			01/12/91	01/12/91	01/12/91
Date Received:			01/14/91	01/14/91	01/14/91
			LO-IC6-	LO-B8-SGFB	LO-B8-SG
Parameter	Units	MDL	SGFS	time 1423	time 1613
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

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REPORT OF LABORATORY ANALYSIS

Mr. Dave Edwards
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January 21, 1991
PACE Project
Number: 910115501

0252 JI/Lenz Oil

Parameter	Units	MDL	10 0012327 01/12/91 01/14/91 LO-1B8- SGMS time 1617	10 0012335 01/12/91 01/14/91 LO-1B8- SGMS time 1620	10 0012343 01/12/91 01/14/91 LO-1-SGTB4 time 1435
PACE Sample Number:					
Date Collected:					
Date Received:					
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

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REPORT OF LABORATORY ANALYSIS

Mr. Dave Edwards
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January 21, 1991
PACE Project
Number: 910115501

0252 JI/Lenz Oil

PACE Sample Number:			10 0013161	10 0013170	10 0013188
Date Collected:			01/14/91	01/14/91	01/14/91
Date Received:			01/15/91	01/15/91	01/15/91
Parameter	Units	MDL	L01C7SG	L01C8SG	L01C9SG
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

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REPORT OF LABORATORY ANALYSIS

Mr. Dave Edwards
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January 21, 1991
PACE Project
Number: 910115501

0252 JI/Lenz Oil

PACE Sample Number:			10 0013196	10 0013200	10 0013218
Date Collected:			01/14/91	01/14/91	01/14/91
Date Received:			01/15/91	01/15/91	01/15/91
Parameter	Units	MDL	L01C10SG	L01C10SGFD	L01C10SGFB
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

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REPORT OF LABORATORY ANALYSIS

Mr. Dave Edwards
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January 21, 1991
PACE Project
Number: 910115501

0252 JI/Lenz Oil

PACE Sample Number:			10 0013226	10 0013234	10 0013242
Date Collected:			01/14/91	01/14/91	01/14/91
Date Received:			01/15/91	01/15/91	01/15/91
Parameter	Units	MDL	L01C11SG	L01C12SG	L01C13SG
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
1,1,1-Trichloroethane	ppm	0.04	ND	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND	ND
Toluene	ppm	0.06	ND	ND	ND
Trichloroethylene	ppm	0.04	ND	ND	ND
Xylene	ppm	0.05	ND	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
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pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Mr. Dave Edwards
Page 7

January 21, 1991
PACE Project
Number: 910115501

0252 JI/Lenz Oil

PACE Sample Number:			10 0013250	10 0013269
Date Collected:			01/14/91	01/14/91
Date Received:			01/15/91	01/15/91
Parameter	Units	MDL	L01C14SG	L01SFTB5
ORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
1,1,1-Trichloroethane	ppm	0.04	ND	ND
1,2-Dichloroethane	ppm	0.05	ND	ND
Toluene	ppm	0.06	ND	ND
Trichloroethylene	ppm	0.04	ND	ND
Xylene	ppm	0.05	ND	ND
cis-1,2-Dichloroethylene	ppm	0.05	ND	ND
trans-1,2-Dichloroethylene	ppm	0.10	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my supervision.

Liesa Shanahan

Liesa A. Shanahan
Organic Chemistry Manager

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3377

PACE, Inc.
Soil Gas Analysis QC Sheet

Client Name: ERM - North Central
Project Name:
PACE Project Number: 910115.501

Instrument ID: D
Primary Column ID: 30 meter, 0.32 mm I.D. Supelco DB-5

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Surrogate Recovery Decane (%)
~~Calib std~~	—	—	1/19/91	97
~~Cal Blk~~				
1226.2	Prime	Front		114
		Back		104
1227.0		Front		111
		Back		105
1228.4		Front		113
		Back		105
1297		Front		111
		Back		104
1230.0		Front		111
		Back		106
~~R.C. spike~~	—	—		96
1231.4	Prime	Front		108
		Back		103
1232.7		Front		107
		Back		103
1233.5		Front		110
		Back		103
1234.3		Front		110
		Back		105

MRB 1/22/91

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Surrogate Recovery Decane (%)
1316.1	Prime	Front	1/19/91	110
		Back		103
R.C. spike	—	—		95
~~Calib std~~	—	—		95
1317.0	Prime	Front		99
		Back		103
1318.8		Front		110
		Back		103
1319.6		Front		109
		Back		102
1320.0		Front		110
		Back		105
1321.9		Front		108
		Back		104
R.C. spike	—	—	1/20/91	95
1322.6	Prime	Front		112
		Back		103
1323.4		Front		111
		Back		105
1324.2		Front		111
		Back		104

Surrogate QC Limits
75%-125%.

Comments

PACE, Inc.
Soil Gas Analysis QC Sheet

Client Name: ERM - North Central Inc.
Project Name:
PACE Project Number: 910115 501

Instrument ID: B
Primary Column ID: 30 meter, 0.32 mm I.D. Supelco DB-5

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Surrogate Recovery Decane (%)
~~47005~~				
13250	Prime	Front	1/20/19	109
		Back		107
13269		Front		110
		Back		104
QC spike				92

MRB 1/22/19

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Surrogate Recovery Decane (%)

rogate QC Limits
... 75%-125%.

Comments

PACE, Inc.
Soil Gas Analysis Calibration Summary

Client Name: ERM - North Central
Project Name:
PACE Project Number: 910115501

Instrument ID: B
Primary Column ID: 30 meter, 0.32 mm ID, Supelco DB-5
Analysis Date: 1/18 & 19/91

Initial Calibration Summary

Analytes	Standards (ug/ml) 5	10	50	100	500	AVE.	%RSD
cis-1, 2-Dichloroethene	0.401	0.470	0.575	0.577	0.577	0.520	16
trans-1, 2-dichloroethene	6.39×10^{-4}	6.16×10^{-4}	6.33×10^{-4}	5.96×10^{-4}	6.18×10^{-4}	6.20×10^{-4}	3
1, 2-Dichloroethane	0.271	0.388	0.518	0.561	0.539	0.465	29
Trichloroethene	0.347	0.395	0.453	0.463	0.461	0.424	12
1, 1, 1-Trichloroethane	0.446	0.446	0.469	0.458	0.446	0.453	2
Toluene	2.04	2.14	2.37	2.29	2.26	2.22	6
m, p-Xylene (Total)	~~1.43~~ 2.22	2.24	2.40	2.33	2.31	2.30	3
o-Xylene	2.22	2.21	2.39	2.32	2.31	2.29	3
Decane (SS)	2.17	2.16	2.29	2.20	2.20	2.20	2

Continuing Calibration Summary

Analytes	Analysis Date	Standard ug	% Diff.	Analysis Date	Standard	% Diff.
cis-1, 2-Dichloroethene	1/19/91	45	9	1/20/91	93	7
trans-1, 2-dichloroethene	1/18/91	58	17	1/19/91	108	9
1, 2-Dichloroethane	1/14/91	53	8	1/20/91	47	4
Trichloroethene	↓	48	6	↓	95	7
1, 1, 1-Trichloroethane		46	7		95	5
Toluene		49	5		100	3
m, p-Xylene (Total)		100	3		102	2
o-Xylene		51	3		104	1
Decane (SS)						

Comments: 1) TRANS-1,2 DICHLOROETHANE WAS RUN ON A SINGLE COLUMN - SUPELCO DB-WAX, 30 meters, 0.25 micron film thickness

2) TRANS-1,2 DICHLOROETHANE WAS CALIBRATED WITH STANDARDS OF 10 ug/ml, 15, 50, 100, & 500

PACE, Inc.
Soil Gas Analysis QC Sheet

Client Name: ERM - West Central
Project Name:
PACE Project Number: 910115501

Instrument ID: B
Primary Column ID: 30 meter, 0.32 mm I.D. Supelcowax 0B-5

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Matrix Spike Recovery (%)					
				1	2	3	4	5	6
~~QC spike~~			1/13/91	100	98	97	94	95	95
~~QC spike~~			1/14/91	101	100	100	96	95	96
~~QC spike~~			1/14/91	99	97	99	95	96	96
~~QC spike~~			1/20/91	93	95	93	94	94	95

Matrix Spike QC Limits are 75%-125%.

1 = cis-1,2-Dichloroethene
2 = 1,1,1-Trichloroethane
3 = Trichloroethene
4 = Toluene
5 = m,p-Xylene
6 = p-Xylene

Comments

PACE, Inc.
Soil Gas Analysis QC Sheet
Method Blank Summary

Client Name: ERM - North central
Project Name:
PACE Project Number: 910115 501

Instrument ID: B
Primary Column ID: 30 meter, 0.32 mm ID
Supelco DB-5

Date Analyzed	Target Compounds
11/9/91	no target compounds found

Comments:

PACE, Inc.
Soil Gas Analysis QC Sheet

Client Name: ERM - North Western
Project Name:
PACE Project Number: 910115.501

Instrument ID: B
Primary Column ID: 30 meter, 0.32 mm I.D. supelco DB-5

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Surrogate Recovery Decane (%)
1232.7 MS	Second	Front	1/23/91	115
	↓	Back	↓	102
1232.5 MSD		Front		112
		Back		103

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Surrogate Recovery Decane (%)

Surrogate QC Limits
are 75%-125%.

Comments _____

PACE, Inc.
Soil Gas Analysis QC Sheet
Method Blank Summary

Client Name: ERM-NORTH CENTRAL
Project Name:
PACE Project Number: 910115.501

Instrument ID: A
Primary Column ID: 30 meter, 0.32 mm I.D. Supelco DB-5

Date Analyzed	Target Compounds
1/23/91	No Target compounds found

Comments:

PACE, Inc.
Soil Gas Analysis Calibration Summary

Client Name: ERM - North Western
Project Name: LENZ oil
PACE Project Number: 910115.501

Instrument ID: B
Primary Column ID: 30 meter, 0.32 mm ID Supelco DB-5
Analysis Date: 1/23/91

Initial Calibration Summary

Analytes	Standards (ug/ml) 5	10	50	100	500	AVE.	%RSD
cis-1, 2-Dichloroethene	0.341	0.492	0.565	0.481	0.493	0.474	17
trans-1, 2-dichloroethene	—	—		—	—		
1, 2-Dichloroethane	—	—	—	—	—		
Trichloroethene MRB 1/24/91	~~0.357~~ 0.361	0.361	0.445	0.395	0.403	0.395	8.3
1, 1, 1-Trichloroethane	0.457	0.421	0.449	0.384	0.386	0.414	8.1
Toluene	2.03	2.08	2.27	2.01	1.98	2.08	5.5
m, p-Xylene (Total)	2.24	2.20	2.35	2.12	2.04	2.19	5.4
o-Xylene	2.29	2.23	2.36	2.12	2.04	2.21	5.8
Decane (SS)	2.23	2.16	2.26	2.05	1.97	2.13	5.7

Continuing Calibration Summary

Analytes	Analysis Date	Standard ug	% Diff.	Analysis Date	Standard	% Diff.
cis-1, 2-Dichloroethene	1/23/91	49	103			
trans-1, 2-dichloroethene		—	—			
1, 2-Dichloroethane		—				
Trichloroethene		50	98			
1, 1, 1-Trichloroethane		49	99			
Toluene		51	98			
m, p-Xylene (Total)		100	98			
o-Xylene		51	97			
Decane (SS)	↓	—	—			

Comments:

PACE, Inc.
Soil Gas Analysis QC Sheet

Client Name: ERM - North Central
Project Name: LEN2 oil
PACE Project Number: 910115.501

Instrument ID: B
Primary Column ID: 30 meter, 0.32 mm I.D. Supelco DB-5

PACE Sample #	Tube (Prime or Second)	Tube Section	Analysis Date	Matrix Spike Recovery (%) 1	2	3	4	5	6
1231.7 MS	SECOND	FRONT	1/23/91	107	108	109	108	107	103
	↓	BACK	↓	99	100	100	98	97	95
1233.5 MSD		Front		103	104	108	105	104	100
		Back		100	102	101	100	99	97

Matrix Spike QC Limits are 75%-125%.

1 = cis-1,2-Dichloroethene
2 = 1,1,1-Trichloroethane
3 = Trichloroethene
4 = Toluene
5 = m,p-Xylene
6 = ~~p-Xylene~~ o-xylene

MRB 1/24/91

Comments

PACE, Inc.

Client Name: ERM - North Central
Project Name: LEN 2 oil
Project #: 910110.505
Instr. ID: B

Mid-level Standard-

Date/Time: 1/15/91 6.00P PM
File ID:
Column ID: 30 meter, 0.32 I.D. Supelco DB-5

Soil Gas Analysis Internal Standard Area Summary

		Bromofluoro-benzene Area	RT			Bromofluoro-benzene Area	RT
	Mid-level Std.	378	9.37		Mid-level Std.		
	Upper Limit	756			Upper Limit		
	Lower Limit	189			Lower Limit		
	PACE Sample No.				PACE Sample No.		
1	[redacted]			21			
2	738.2 l'mmng-F	343	9.38	22			
3	l'mmng-B	340	9.37	23			
4	739.3 l'mmng-F	317	9.37	24			
5	l'mmng-B	332	9.37	25			
6	740.4 l'mmng-F	327	9.37	26			
7	l'mmng-B	344	9.37	27			
8	L.C. Spike	358	9.37	28			
9				29			
10				30			
11				31			
12				32			
13				33			
14				34			
15				35			
16				36			
17				37			
18				38			
19				39			
20				40			

B 1/23/91

QC Limits for Area

UPPER LIMIT = +100% of internal standard area
LOWER LIMIT = -50% of internal standard area.

Retention Time QC Limits

Retention time window is +/- 0.50 minutes.

PACE, Inc.

Client Name: ERM - North Central
Project Name: LENZ oil
Project #: 9101122.502
Instr. ID: B

Mid-level Standard-

Date/Time:
File ID:
Column ID: 30 meter, 0.32 I
Angelus DB-5

Soil Gas Analysis Internal Standard Area Summary

		Bromofluoro-benzene Area	RT			Bromofluoro-benzene Area	RT
	Mid-level Std.	378	9.37		Mid-level Std.		
	Upper Limit	756			Upper Limit		
	Lower Limit	189			Lower Limit		
	PACE Sample No.				PACE Sample No.		
1	1050.2 Primary-F	345	9.37	21	1059.6 Primary-F	317	9.37
2	Primary-B	326	9.37	22	Primary-B	336	9.37
3	1051.0 Primary-F	315	9.37	23	1058.8 MSD	330	9.37
4	Primary-B	336	9.38	24	1060.0 Primary-F	324	9.37
5	1052.9 Primary-F	321	9.37	25	Primary-B	343	9.37
6	Primary-B	341	9.37	26	1061.8 Primary-F	319	9.37
7	1053.7 Primary-F	354	9.37	27	Primary-B	337	9.37
8	Primary-B	341	9.37	28	1062.6 Primary-F	337	9.37
9	1054.5 Primary-F	309	9.37	29	Primary-B	334	9.37
10	Primary-B	334	9.37	30	QC. Spike	340	9.37
11	[redacted]			31			
12	1058.8 MS	340	9.37	32			
13	1055.3 Primary-F	322	9.37	33			
14	Primary-B	327	9.37	34			
15	1056.1 Primary-F	314	9.37	35			
16	Primary-B	330	9.37	36			
17	1057.0 Primary-F	316	9.37	37			
18	Primary-B	332	9.37	38			
19	1058.8 Primary-F	326	9.37	39			
20	Primary-B	339	9.37	40			

MRB 1/23/01

QC Limits for Area

UPPER LIMIT = +100% of internal standard area
LOWER LIMIT = -50% of internal standard area.

Retention Time QC Limits

Retention time window is +/- 0.50 minutes.

PACE, Inc.

Client Name: ERM - North Central
Project Name: LENZ oil
Project #: 9010112.503
Instr. ID: B

Mid-level Standard-

Date/Time: 1/16/91 3 39 PM
File ID:
Column ID: 30 meter, 0.32 mm I.D. Supelco DB-5

Soil Gas Analysis Internal Standard Area Summary

		Bromofluoro-benzene Area	RT			Bromofluoro-benzene Area	RT	
	Mid-level Std.	356	9.37		Mid-level Std.			
	Upper Limit	712			Upper Limit			
	Lower Limit	178			Lower Limit			
	PACE Sample No.				PACE Sample No.			
1	SS2 Blk	349	9.37	21	1272.3 Primary-F	325	9.37	
2	1263.4 Primary-F	337	9.38	22	Primary-B	348	9.37	
3	Primary-B	330	9.38	23	Q.C. spike	363	9.37	
4	1264.2 Primary-F	303	9.38	24	1273.1 Primary-F	337	9.37	
5	Primary-B	332	9.38	25	Primary-B	355	9.37	
6	1265.0 Primary-F	324	9.37	26	1274.0 Primary-F	339	9.37	
7	Primary-B	342	9.37	27	Primary-B	336	9.37	
8	1266.9 Primary-F	321	9.37	28	1275.8 Primary-F	335	9.37	
9	Primary-B	333	9.37	29	Primary-B	~~353~~ 348	9.37	RRS 1/23/91
10	1267.7 Primary-F	320	9.37	30	Q.C. spike	363	9.37	
11	Primary-B	333	9.37	31				
12	Q.C. spike	343	9.37	32				
13	1268.5 Primary-F	317	9.37	33				
14	Primary-B	310	9.37	34				
15	1269.3 Primary-F	321	9.37	35				
16	Primary-B	335	9.37	36				
17	1270.7 Primary-F	329	9.37	37				
* 18	Primary-B	—	—	38				
19	1071.5 Primary-F	329	9.37	39				
20	Primary-B	341	9.37	40				

QC Limits for Area

UPPER LIMIT = +100% of internal standard area
LOWER LIMIT = -50% of internal standard area.

Retention Time QC Limits

Retention time window is +/- 0.50 minutes.

* no internal std injected into sample, reported values taken from ~~Area~~ confirmation column (DB-1701) using external calibration

PACE, Inc.

Client Name: ERM - North Central
Project Name: LENZ Oil
Project #: 9101157.501
Instr. ID: B

Mid-level Standard-

Date/Time: 1/19/91 1:58 PM
File ID:
Column ID:

Soil Gas Analysis Internal Standard Area Summary

		Bromofluoro-benzene Area	RT			Bromofluoro-benzene Area	RT
	Mid-level Std.	413	9.37		Mid-level Std.		
	Upper Limit	326			Upper Limit		
	Lower Limit	206			Lower Limit		
	PACE Sample No.				PACE Sample No.		
1	CCV Std	362	9.37	21	1316.1 Primary-F	338	9.37
2	1226.2 Primary-F	340	9.37	22	Primary-B	349	9.37
3	Primary-B	385	9.37	23	Q.C. Spike	357	9.37
4	1227.0 Primary-F	391	9.37	24			
5	Primary-B	356	9.37	25			
6	1228.9 Primary-F	343	9.37	26			
7	Primary-B	352	9.37	27			
8	1229.7 Primary-F	345	9.37	28			
9	Primary-B	353	9.37	29			
10	1230.0 Primary-F	337	9.37	30			
11	Primary-B	393	9.37	31			
12	Q.C. Spike	387	9.37	32			
13	1231.4 Primary-F	323	9.37	33			
14	Primary-B	355	9.37	34			
15	1232.7 Primary-F	318	9.37	35			
16	Primary-B	353	9.37	36			
17	1233.5 Primary-F	336	9.37	37			
18	Primary-B	359	9.37	38			
19	1234.3 Primary-F	362	9.37	39			
20	Primary-B	357	9.37	40			

QC Limits for Area

UPPER LIMIT = +100% of internal standard area
LOWER LIMIT = -50% of internal standard area.

Retention Time QC Limits

Retention time window is +/- 0.50 minutes.

PACE, Inc.

Client Name: ERM - North Western
Project Name: LEN 2 SU
Project #: 9101155 01
Instr. ID: B

Mid-level Standard-

Date/Time: 11/20/91 2.50 A.M.
File ID:
Column ID: 30 meter, 0.32 mm I.D. Supelco DB-5

Soil Gas Analysis Internal Standard Area Summary

		Bromofluoro-benzene Area	RT			Bromofluoro-benzene Area	RT
	Mid-level Std.	388	9.37		Mid-level Std.		
	Upper Limit	776			Upper Limit		
	Lower Limit	194			Lower Limit		
	PACE Sample No.				PACE Sample No.		
1	1317.0 Primary - F	330	9.37	21	1326 Primary - B	365	9.37
2	Primary - B	357	9.37	22			
3	1318.8 Primary - F	345	9.37	23			
4	Primary - B	353	9.37	24			
5	1319.6 Primary - F	329	9.37	25			
6	Primary - B	348	9.37	26			
7	1320.0 Primary - F	345	9.37	27			
8	Primary - B	349	9.37	28			
9	1321.8 Primary - F	342	9.38	29			
10	Primary - B	348	9.38	30			
11	Q.C Aroclor	376	9.38	31			
12	1322.6 Primary - F	378	9.37	32			
13	Primary - B	355	9.37	33			
14	1323.4 Primary - F	351	9.37	34			
15	Primary - B	355	9.37	35			
* 16	1324.2 Primary - F	688	9.37	36			
17	Primary - B	358	9.37	37			
18	1325.0 Primary - F	347	9.37	38			
19	Primary - B	360	9.37	39			
20	1326.4 Primary - F	351	9.37	40			

QC Limits for Area

UPPER LIMIT = +100% of internal standard area
LOWER LIMIT = -50% of internal standard area.

Retention Time QC Limits

Retention time window is +/- 0.50 minutes.

* 1324.2 Primary Front — Sample was accidentally injected with 20 ul of the internal std — area count is double normal

PACE, Inc.

Client Name: ERM - North Central
Project Name: LEN 2 oil
Project #: 910115 501
Instr. ID: B

Mid-level Standard-

Date/Time: 1/23/91 4.000 M
File ID:
Column ID: 30 meter, 0.32 I.D
Supelco DB-5

Soil Gas Analysis Internal Standard Area Summary

		Bromofluoro-benzene Area	RT			Bromofluoro-benzene Area	RT
	Mid-level Std.	355	9.33		Mid-level Std.		
	Upper Limit	710			Upper Limit		
	Lower Limit	178			Lower Limit		
	PACE Sample No.				PACE Sample No.		
1	CS2 Blk	367	9.33	21			
2	1232.7 (MS) Front	356	9.33	22			
3	Back	345	9.33	23			
4	1233.5 (MSD) Front	332	9.33	24			
5	Back	347	9.33	25			
6				26			
7				27			
8				28			
9				29			
10				30			
11				31			
12				32			
13				33			
14				34			
15				35			
16				36			
17				37			
18				38			
19				39			
20				40			

QC Limits for Area

UPPER LIMIT = +100% of internal standard area
LOWER LIMIT = -50% of internal standard area.

Retention Time QC Limits

Retention time window is +/- 0.50 minutes.

ERM-North Central, inc.

LO1991A

Sample Chain of Custody

W.O.No.: 0252JI | Project Name: LENZ OIL | Sampler: BBM, HVJ, CVB

ERM Sample Number	Date	Time	COMP	GRAB	Station Location	Number of Containers	1,2 DCA, 1,2 DCE	TCE, 1,1,1 TCA	Toluene, Xylene				Remarks
1	1/9/91	1650		✓	LO-1A1-SGSOA	1	✓	✓	✓				FEDX # 8194625810
2	1/9/91	1730		✓	LO-1A1-SGFB	1	✓	✓	✓				TWO TUBES PER SAMPLE CONTAINER.
3	1/9/91	1700		✓	LO-1-SGTB1	1	✓	✓	✓				
													ALL SAMPLES COOLED AT 4°C.
				*	7 DAY TURNAROUND								LO-1A1-SG (PRIMARY - LOT # CT-1625)
				*	FOLLOW LENZ OIL SOA FOR SOIL GAS ANALYSIS								" " (SECONDARY-LOT # CT-1629)
													LO-1A1-SGFB (PRIMARY LOT # CT-1630)
													" " (SECONDARY LOT # CT-1528)
													LO-1-SGTB1 - LOT # CT-1561 & # CT-1565

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer
D.P. Ebert 01300	1/9/91	1845	Fed-X	1-9-91	1845	Shipping
			Madeline Mullu	1/10	9:45	

YES: White & Yellow copies accompany sample shipment to laboratory. Yellow copy retained by laboratory. White copy to be returned to ERM for files. Pink copy retained by sampler. Gold copy extra copy as needed

ERM-North Central, inc.

COC# - LO110910

Sample Chain of Custody

W.O.No.: 0252JI

Project Name: LENZ OIL

Sampler: BBM, HVJ, CJB, DPE

FEDX# 819462 5795

ERM Sample Number	Date	Time	COMP	GRAB	Station Location	Number of Containers	1,2 DCA, 1,2 DCE	TCE, 1,1,1 TCA	TOLUENE, XYLENE			Remarks
1	1/10/91	11:00		✓	LO-1A2-SG 1050.2	1	✓	✓	✓			PRIMARY LOT# CT1592, SEC.# CT 1595
2	"	1106		✓	LO-1A3-SG 1051.0	1	✓	✓	✓			PRIMARY LOT# CT 1556, SEC.# CT 1594
3	"	1111		✓	LO-1A4-SG 1052.9	1	✓	✓	✓			PRIMARY LOT # CT 1589, SEC# CT 1593
4	"	1116		✓	LO-1A4-SGFS 1053.7	1	✓	✓	✓			PRIMARY LOT # CT 1591, SEC.# CT 1586
5	"	1247			LO-1A5-SG 1054.5	1	✓	✓	✓			PRIMARY LOT # CT 1562, SEC.# CT 1587
6	"	1240			LO-1A7-SG 1055.3	1	✓	✓	✓			PRIMARY LOT # CT 1590, SEC.# CT 1588
												- ALL SAMPLES COOLED AT 4°C
				*	7 DAY TURNAROUND							- TWO TUBES PER SAMPLE
				*	FOLLOW LENZ OIL SOP							CONTAINER
					FOR SOIL GAS ANALYSIS							

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer
[signature]	1/10/91	1900	FEDX	1/10/91	1900	SHIPPING
			M&E - Reno	1/12/91	1100	

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ERM-North Central, inc.

C#-LO11091B2

Sample Chain of Custody

W.O.No.: 0252JI | Project Name: LENZ OIL

Sampler: BBM, DPE, HVJ, CJB

FEDX# 819462579 5

ERM Sample Number	Date	Time	COMP	GRAB	Station Location	Number of Containers	1,2 DCA	TCE, 1,1,1 TCA	Toluene, Xylene				Remarks
7	1/10/91	1615		X	LO-1A6-SG 1056.1	1	✓	✓	✓				PRIMARY Lot#CT1574 Sec.#CT1566
8		1620		✓	LO-1A8-SG 1057.0	1	✓	✓	✓				PRIMARY Lot#CT1564 Sec#CT1560
9		1619		✓	LO-1A8-SGMS 1058.8	2	✓	✓	✓	(MS/MSD)			PRIMARY Lot#CT 1567 1571 Sec#CT 1569 1575
10		1631		✓	LO-1A9-SG dup 1059.6	1	✓	✓	✓				PRIMARY Lot#CT1573 Sec#CT1570
11		1715		✓	LO-1B9-SG 1060.0	1	✓	✓	✓				PRIMARY Lot#CT1645 Sec#CT1572
12		1640		✓	LO-1B9-SGFB 1061.8	1	✓	✓	✓				PRIMARY Lot#CT1568 Sec#CT1649
13		1610		✓	LO-1-SGTB 21062.6	1	✓	✓	✓	BBM			~~PRIMARY Lot#CT BBM Sec#CT~~
				X	7 DAY TURNAROUND								- ALL SAMPLES COOLED AT 4°C.
				*	FOLLOW LENZ OIL SOP								- TWO TUBES PER SAMPLE CONTAINER
					FOR SOIL GAS ANALYSIS								

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer
[signature]	1/10/91	1900	FED-X	1/10/91	1900	SHIPPING
			MSL - Lab	1/12/91	1100	

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9101172503

ERM-North Central, inc.

COC# LO 11191C

Sample Chain of Custody

W.O.No.: 0252JI | Project Name: LENZ OIL

Sampler: BBM, HVJ, CJB, DPE 013104

FEDX# 8194625806

ERM Sample Number	Date	Time	COMP	GRAB	Station Location	Number of Containers	1,2DCA, BNZ	TCE, 1,1,1 TCA	TOLUENE, XYLENE			Remarks
1	1/11/91	1043		✓	LO-1B1-SG 1063.4	1	✓	✓	✓			PRIMARY LOT#CT 1598 SEC#CT 1612
2		1047		✓	LO-1B2-SG 1064.2	1	✓	✓	✓			PRIMARY LOT#CT ~~1644~~ 1644 BBM SEC#CT 1651
3		1050		✓	LO-1B3-SG 1065.0	1	✓	✓	✓			PRIMARY LOT#CT 1646 SEC#CT 1650
4		1054		✓	LO-1B4-SG 1066.9	1	✓	✓	✓			PRIMARY LOT#CT 1706 SEC#CT 1610
5		1057		✓	LO-1B5-SG 1067.7	1	✓	✓	✓			PRIMARY LOT#CT 1609 SEC#CT 1613
6		1200		✓	LO-1B6-SG 1068.5	1	✓	✓	✓			PRIMARY LOT#CT 1640 SEC#CT 1636
7		1101		✓	LO-1B7-SG 1069.3	1	✓	✓	✓			PRIMARY LOT#CT 1614 SEC#CT 1611
				*	7 DAY TURNAROUND							- ALL SAMPLES COOLED AT 4°C
				*	FOLLOW LENZ OIL SOP FOR SOIL GAS ANALYSIS							- TWO TUBES PER SAMPLE CONTAINER

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer
[signature]	1/11/91	1900	FEDX	1/11/91	1900	SHIPPING

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ERM-North Central, inc.

COC # LO1119IC2

Sample Chain of Custody

W.O.No.: 0252JI | Project Name: LENZ OIL

Sampler: BBM, HWJ, CJB, DPF

FEDX # 819462580 6

ERM Sample Number	Date	Time	COMP	GRAB	Station Location	Number of Containers	1,2 DCA, 1,2 DCE	TCE, 1,1,1 TCA	TOLUENE, XYLENE			Remarks
8	1/11/91	1400		✓	LO-IC1-SGFB 1070.7	1	✓	✓	✓			PRIMARY Lot#CT 1615 Sec#CT *
9		1738		✓	LO-IC1-SG 1071.5	1	✓	✓	✓			PRIMARY Lot#CT 1635 Sec#CT 1637
~~10~~				✓	~~LO-IC2-SG~~	1	✓	✓	✓			~~PRIMARY Lot#CT Sec#CT~~ 1514 M
~~11~~		~~1500~~		✓	~~LO-IC3-SG~~	1	✓	✓	✓			~~PRIMARY Lot#CT Sec#CT~~ BBM
12		1457		✓	LO-IC4-SG 1072.3	1	✓	✓	✓			PRIMARY Lot#CT 1576 Sec#CT 1592
13		1453		✓	LO-IC4-SGFS 1073.1	1	✓	✓	✓			PRIMARY Lot#CT 1553 Sec#CT 1588
14		1500		✓	LO-IC5-SG 1074.0	1	✓	✓	✓			PRIMARY Lot#CT 1634 Sec#CT 1538
15		1630		✓	LO-1-SGTB3 1075.8	1	✓	✓	✓			- ALL Samples cooled at 4°C
				*	7 DAY TURNAROUND							- Two tubes per sample container
				*	ACCORD LENZ OIL SOP FOR SOIL GAS ANALYSIS							

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer
[signature]	1/11/91	1900	FED X	1/11/91	1900	SHIPPING

* SECONDARY SAMPLE FOR LO-IC1-SGFB BROKE

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ERM-North Central, inc.

COC #L011291D

Sample Chain of Custody

W.O.No.: 0252JI | Project Name: LENZ OIL

Sampler: BBM, HVJ, CJB, DPE

FEDX # 819462573 6

ERM Sample Number	Date	Time	COMP	GRAB	Station Location	Number of Containers	1,2 DCA, 1,2 DCE	TCE, 1,1,1 TCA	TOLUENE, XYLENE				Remarks
1	1/12/91	1045		✓	LO-IC2-SG	1	✓	✓	✓		12	26	2	PRIMARY Lot #CT 1597, Sec #CT 1605
2		1129		✓	LO-IC3-SG	1	✓	✓	✓			27	0	PRIMARY Lot #CT 1599 Sec #CT 1580
3		1310		✓	LO-IC6-SG	1	✓	✓	✓			28	9	PRIMARY Lot #CT 1596, Sec #CT 1604
4		1316		✓	LO-IC6-SGFS	1	✓	✓	✓			29	7	PRIMARY Lot #CT 1578 Sec #CT 1584
5		1423		✓	LO-IB8-SGFB	1	✓	✓	✓			30	0	~~PRIMARY Lot #CT ~~ ~~Sec #CT~~
6		1613		✓	LO-IB8-SG	1	✓	✓	✓			31	9	~~PRIMARY Lot #CT ~~ ~~Sec #CT~~
7		1612 & 1620		✓	LO-IB8-SGMS	2	✓	✓	✓			32	7	~~PRIMARY Lot #CT ~~ ~~Sec #CT~~
8		1435		✓	LO-I-SGTB4	1		✓	✓			33 34	5 3	Lot #'s
		* 7 DAY TURNAROUND												— ALL SAMPLES COOLED AT 4°C
		* FOLLOW LENZ OIL SOP FOR SOIL GAS ANALYSIS												— TWO TUBES PER SAMPLE CONTAINER

NO CT #'S

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer
[signature]	1/12/91		FED X	1/12/91		SHIPPING
			Madeline Mullin '14			

* SAMPLE LO-IC1-SG WAS TAKEN AT 1800 HOURS INSTEAD OF 1738 AS LABEL SHOWS AND COC FROM 1/11/91. THE SAMPLE VOLUME SHOULD BE ADJUSTED TO 294 LITERS INSTEAD OF THE 25 LITERS THE SOP REQUIRES. PLEASE ANALYZE ACCORDINGLY.

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COC # L01174FE

ERM North Central, Inc.

Sample Chain of Custody

W.O.No.: 0252 JL | Project Name: LENZ OIL

Sampler: HVJ, CJB, DPE

FED X # 8194625725

ERM Sample Number	Date	Time	COMP	GRAB	Station Location	Number of Containers	1,2 DCA, 1,2 DCE	TCE, 1,1,1 TCA	TOLUENE, XYLENE	[illegible]	[illegible]		Remarks
1	1/14/91	1105 HJ		✓	L01C7SG 1316.1	1	✓	✓	✓				NO CT #'s FOR THIS
2	↓	1107		✓	L01C8SG 1317.0	1	✓	✓	✓				BATCH OF SAMPLES
3		1105		✓	L01C9SG 1318.8	1	✓	✓	✓				
4		1057		✓	L01C10SG 1319.6	1	✓	✓	✓				ALL SAMPLES COOLED TO 4°C
5		1101 (~~1045~~ HJ)		✓	L01C10SGFD 1320.0	1	✓	✓	✓				
6		1045		✓	L01C10SGFB 1321.8	1	✓	✓	✓				
7		16:16		✓	L01C11SG 1322.6	1	✓	✓	✓				
8		15:32		✓	L01C12SG 1323.4	1	✓	✓	✓				
9		15:38		✓	L01C13SG 1324.2	1	✓	✓	✓				
10		15:48		✓	L01C14SG 1325.0	1	✓	✓	✓				
11	↓	16:30		✓	L01SGTB5 1326.9	1	✓	✓	✓				

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer
[signature]	1/14/91		FED X	1/14/91		SHIP TO LAB

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